THE MEDITERRANEAN NATURALIST

A

MONTHLY JOURNAL OF NATURAL SCIENCE

edited by

JOHN. H. COOKE,

B. Sc., F. G. S., F. R. G. S., etc.

"Hear the truths that Nature loves to tell."

VOLUME I.

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NOTICES.

THE MEDITERRANEAN NATURALIST *is published on the 1st of each month. Annual subscription 4s. By post 5s.*

Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

NOTE:—Among the gentlemen who are going to contribute articles to our future numbers are the following:—

Professor G. Capellini, Senatore del Regno. Bologna
Il Cav. G. Jervis F.G.S. Director of the Royal Museum, Turin.
Dr. Johnstone Lavis M.D., M.R.C.S., F.G.S., B.Sc., &c. Naples.
T. Mellard Reade, C.E., F.G.S., F.R.I.B.A., Liverpool.
Lt. General Sir Robt. Biddulph K.C.M.G. late High-Commissioner for Cyprus.
Dr. Z. Hunter M.B., Cairo.

To Correspondents.

All communications intended for insertion should be written on one side of the paper only; and should reach the Editor on or before the 12th of the month. Whenever an answer is required through the post, a stamped and directed envelope should be enclosed.

Secretaries of Societies are invited to forward us reports of their proceedings; and Curators of Museums will confer a favour by informing us of any new and important additions that may be made to their collections.

PROGRAMME.

THE principal object, that we have in view in thus adding another publication to the already long list of periodical literature, is to provide naturalists with a paper that shall be devoted to the natural history of the Mediterranean and of its islands and of its shores.

If we are to judge by the numerous enquiries that are constantly being made for such a paper, it would seem that we are supplying a long felt want; and therefore any further apologies for its appearance would be superfluous.

The number of those, who are engaged in studying the various branches of the natural history of the Mediterranean and the adjoining districts, is large, and their work is of the highest scientific interest and importance; but hitherto many of the results of their labours have been made known only to a limited few, and this, because they have been published either by societies whose journals are not accessible to the majority of workers, or because they are so scattered in the field of scientific literature that the regular gleaning of them has been rendered a most laborious, if not an impracticable task.

As far as lies in our power, we shall gather together such results and report them for the benefit of our readers.

Original articles on Mediterranean geology, zoology, and botany will form a pro-

minent feature of the journal, and will, we trust, be the means of doing much towards creating interest, and stimulating research in these sciences.

Space will be set apart for the comparison of notes, and for the discussion of scientific questions of current interest.

Reviews of scientific literature will also appear; and a *precis* of the most important articles will be given.

Such are a few of the more prominent features of the programme which we shall endeavour to follow. To enable us to carry it out effectively, we would invite the aid of our readers and other scientific workers; for the success of a journal of this description depends not so much on the exertions of its Editor, as on the cooperation of its contributors. While, therefore, asking them to accord us their hearty support, we promise to spare no pains to render "The Mediterranean Naturalist" worthy of their confidence, and of the sciences whose humble servitor it aspires to be.

A short history of the study of the Foraminifera in Italy by Professor G. Capellini.*

The study of the Rhizopods, that have played such an important part in the constitution both of the calcareous and siliceous rocks from the most remote geological ages, has lately acquired a still greater importance in consequence of the discoveries made in the ocean depths by means of the investigations that were carried out during the voyages of the "Lightning", and of the "Porcupine" from 1868-70, of the "Challenger' from 1872-76, of the "Blake", of the "Travailleur" 1880-82, of the "Falisman" 1883, and of other English, American, and French ships, and latterly by the expedition which was undertaken by the "Vettor Pisani."

It was, during these expeditions, that the intimate relations that exist between the calcareous rocks, and the glorigerina ooze which was collected at a depth of about 4000 metres, and between the siliceous rocks and the radiolarian mud that was found in even greather dephts, were established.

This branch of study, as I have already had occasion to record, (1) had its origin Bologna in the year 1730, owing to the patient researches and fortunate discoveries of Jacopo Bortolomeo Beccari, who gave an account of them to our Academy in a memoir which was afterwards published in the first volume of the Commentaries under the title: "De bononiensi arena quadem."

Beccari demonstrated that the yellow sands of the hills around Bologna were deposited in the depths of the sea, and in the course of his researches with the microscope, he succeeded in finding, mixed with the grains of sand, large quantities of minute shells, that he showed to be of marine origin and which he named "Corni di Ammone".

It is well known to all who are engaged in the study of natural history, that after these discoveries of Beccari, Jano Planco (2) found many varieties of similar shells on the shores of Rimini and thus while adding considerably to the Roman naturalist's personal reputation, the discovery also had the effect of inducing others to occupy themselves in similar researches.

Among these we note the names of Gualtieri of Florence 1742, and Ferdinando Bassi of Bologna 1757. (3)

Bassi not only discovered the microscopical "Corni di Ammone o Nautili" that are now included among the foraminifera, but he also

** Read before the Royal Academy of Science of Bologna.*

(1) Capellini. G.—Geologia e Palcontologia del Bolognese. Cenno storico. Bologna 1862.

Capellini. G.—Sull'analisi meccanica delle roccie crittomere per mezzo delle lamine sottili e del microscopio. Rendie asc. Sc. Bol., 3 febbraio 1875.

Capellini. G.—Il maciyno di Porretta e le Roccie a Globigerine dell'Apennino Bolognese. mem. accad. delle Sc. di Bologna, Serie IV. Tom. II. 1880.

(2) Planco J.—De conchis minus notis liber. 1739.

(3) Bassi F.—De quibusdom exiguis madreporis agri bononiensis. Bon. Sc. Art. Inst. Acad. Comm. Vol. IV. Opuscula pag. 49 Bon 1757.

Fornasini C.—I foraminiferi della Tabella Oryctographica esistente nel Museo geologico di Bologna, Boll. Soc. geol. ital. Roma 1884.

made accurate sections of these and of other forms of the *polythalamia* for the purpose of studying the number and forms of the chambers.

Of these sections, we still have examples preserved in the historical collection of the geological museum, and by their means we are able to show to Italy the kind of investigation which has since acquired such great importance in consequence of the labours of the naturalists Munier-Chalmas and Schlumberger (4) who have been carrying out investigations on the dimorphism of the foraminifera in France, and the researches of Fornasini who is recognised as an authority (5) on the subject not only by these authors, but also by all others who are engaged in this branch of study.

After Bassi, Father Ambrogio Soldani of Pratovecchio published at Siena in the year 1780 his celebrated observations on the Nautilus and ammonite regions of Tuscany, (6) and afterwards, by means of his great work "Testaceographia ac zoophytographia parva et microscopia" which was written 1789-1798, he rendered his own name immortal and secured to Italy the great honour of having been the first to encourage and develope the branch of zoology and paleontology that had been commenced a half a century before by means of the discovery which was made by the Bologna scientist.

For many years no Italian naturalist followed the brilliant example that had been set by Soldani.

Michelotti in 1841 (7) and Oronzio Gabriele Costa in 1855 endeavoured to revive the study of the foraminifera; and the latter devoted himself to the fauna of Southern Italy. (8)

Almost contemporaneously Giuseppe Meneghini studied and arranged the more common of the tertiary foraminifera of Tuscany; while shortly after, his pupil Orazio Silvestri evinced a desire to continue the work of the great Soldani.

But Silvestri, unfortunately, confined his attention to a memoir on the Nodosarie, an exhaustive treatise that was not published until after the author had abandoned the study of the rhizopods, and at a time when he was devoting all of his energies to the study of chemistry. (9)

During the period 1859-1879 Giuseppe Seguenza made known to us the foraminifera of Sicily, and in part also that of Calabria (10); while in 1880 Guglielmo Terrigi figured the foraminifera of the tertiary formations of Rome (11).

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(4) Munier-Chalmas—Sur de dimorphisme des Nummulites, Bull. Soc. géol. de France, 3e Serie, T. VIII, p. 300, Paris, 1880.

Schlumberger—Sur le Biloculina depressa d'Orb. au point de vue du dimorphisme des foraminiféres. Assoc. francaise pour l'Avancement des Sciences. Congrés de Rouen, 1883.

Munier-Chalmas et Schlumberger — Nouvelles oberservation sur le dimorphisme des foraminiféres. Comptes rendus des séances de l'Acad. des Sciences de Paris. Seánce 28 Mai 1883.

(5) Schlumberger—Note sur les Biloculina bulloides d'Orb. et B. ringeus Lam. (Bull. Soc. Géol. France, 3e Serie, T. XV. p. 119)—1887.

Schlumberger—Note sur les Foraminiféres fossiles de la province d'Angola (Bull. Soc. Géol. France, 3e Serie, T. XVI) Paris, 1888.

(6) Soldani A. Saggio orittografico ovvero osservazioni sopra le terre nautiliche ed ammonitiche della Toscana con appendice e catalogo dei piccoli testacci. Siena, 1780.

Soldani A.—Testaceographiæ ac Zoophitographiæ parvæ et microscopicæ Tomus primus. Senis MDCCLXXXIX—*Tomus secundus,* MDCCXCVIII.

(7) Michelotti G.—Saggio storico sui Rizopodi caratteristici dei terreni sopra cretacei (Mem. Soc. Ital. Sc. vol. XXII*).*

(8) Costa O. G.—Foraminiferi fossili delle marne terziarie di Messina. Mem. accad. Sc. di Napoli, vol. II. Napoli 1855.

Costa O. G.—Paleontologia del regno di Napoli Parte 2da. Atti Acc. Poniana, vol. VII. Napoli 1856.

(9) Silvestri O.—Le Nodosarie fossili nel terreno subapennino italiano e viventi nei mari d'Italia. (Atti dell'Acc. Gioenia di scienze nat. Ser. 3a. vol. VII) Catania, 1872.

(10) Seguenza G.—Intorno ad un nuovo genere di Foraminiferi fossile del terreno Miocenico di Messina. (Eco Peloritano, Giorn. di Sc. lett. ed arti, anno V. Ser. 2a.) Messina, 1859.

Seguenza G.—Prime ricerche intorno ai Rizopodi fossili delle argile pleistoceniche del dintorno di Catania (Atti Acc. Gioenia di Sc. nat. Ser. 2a. vol. XVIII.) Catania, 1862.

Seguenza G.—Descrizione dei Foraminiferi monotalamici delle marne mioceniche del distretto di Messina. Messina, 1862.

Seguenza G.—Le Formazioni terziarie nella provincia di Reggio (Calabria). (Atti della R. Accad. dei Lincei, Serie 3a. Mem. classe Sc. fisiche e nat. vol. VI.) Roma, 1879.

(11) Terrigi G.—Fauna vaticana a foraminiferi delle sabbie gialle nel plioceno subapennino superiore. (Atti della Accad. pont. dei Nuovi Lincei, vol. XXXIII.) Roma, 1880.

In the mean-time Carlo Fornasini of Bologna, the laureate in natural science in 1877, after having throughly prepared himself in this branch of study, went to Vienna, Monaco, Berlin, Brussels, and Paris for the purpose of studying the collections in those places, and in order that he might consult those who had made the study their speciality.

The work, by which Fornasini made himself first known, referred to the Pliocene Marls of Ponticello and Savena; interesting localities that have since been honoured by the visits of the most eminent geologists, among whom may be noted Herbert, Prestwich, Renevier, Fontannes, Hantken, Van-den Broeck and Rutot, the last having gone there expressly for the purpose of examining the clay, from which Fornasini had obtained the foraminifera, that he has figured in his works.

Fornasini has given remarkable proofs of his patience and perseverance, for he has already published a large number of works that deal exclusively with the foraminifera, and about which I shall here cite the opinion which was expressed by Dollfus of Paris in the "Rivista geologica universale" of last year.

Gustavo Dollfus, after having declared that Fornasini, in consequence of his many and interesting researches about the foraminifera, is following in the footsteps of Gaultieri, Planco, and Soldani, proceeds to state that Fornasini was engaged on a great work that had reference to the numerous and varied forms of the little animals whose remains occur in such abundance in Italian Strata.

He passes in review some of Fornasini's more recent publications, and, after referring to the work entitled "Revisione dei foraminiferi illustrati dal Soldani" as a "*oeuvre considerable*" he thus concludes: *S'il était possible de faire une reproduction des planches de Soldani que leur rareté éloigne de la plupart des travailleurs, elle deviendraient, avec le travail de révision de M. Fornasini, le livre de chevet de tous les étudiants micrographes.*"(12)

Unfortunately the desired reproduction is impossible as, after having given rare proofs of his untiring zeal and perseverance, after having spent more than thirty years on the work of which he published the first volume in 1789 and which he illustrated with one hundred and seventy-nine plates, the indefatigable priest was "discouraged by the unfavourable reception that the book met with at the hands of the public after all his labour and anticipations, and in a moment of ill humour he consigned the greater part of the second volume to the flames, and threw the engraving blocks into the melting-pot."

Giambattista Brocchi in his famous discourse "Sui progressi dello studio della Conchiologia fossile in Italia" which was pubblished in 1814, remarks that "Though Soldani had a right to the appreciation of the people, yet he made a mistake in thus limiting the scope of his work by confining his attention to the formations of his own country only, for he adds in a tone of indignation, "The taste for natural sciences seemed to be then declining, and it was the custom of the Italians who were then living (1789) to show a certain fastidiousness or carelessness, or to speak more correctly a certain contempt for native genius, and a blind, servile, and stupid admiration for that of strangers." (13)

I trust that this important branch of study, which had its origin in Bologna, will continue to produce from among us such talented workers, and exact thinkers.

(12) Annuaire gèologique universel, *Revue de Géologie et Paleontologie. 2e partie, Foraminifères, par Gustave Dollfus, pag. 207, 208. Paris 1887.*

(13) *Brocchi. G.—Conchiologia fossile subapennina. Tomo I. p. LPIV, LXVII. Milano 1814.*

A New Maltese Chelonian.

TRIONYX MELITENSIS.

Mr. R. Lydekker, B.A., F.G.S., of the British Museum read a paper at a recent meeting of the Geological Society of London* in which he figured and described a portion of the middle and right half of the anterior region of the Carapace of a large Chelonian, referable to the family Trionychidæ, which had been obtained by Dr. John Murray during his visit to Malta in the summer of 1890.

In many respects it is distinctly analagous to certain species of Trionyx (viz. *T. gangeticus T. Leithi*, and *T. hurum*) that at present exist in the

* *Vol. XLVII. No. 185. Quart: Journ: Geo: Soc:*

Indian seas, while in others, the resemblances are such as would seem to indicate that it is closely allied to the existing *Chitra indica*.

After describing the characteristic features of the specimen and pointing out the affinities and differences that it bears to the genus *Chitra*, and the genus *Trionyx*, the author concludes by summing up the evidences in favour of the latter, and accordingly proposes to name the new fossil *Trionyx Melitensis*.

Manganese nodules

At a recent meeting of the Royal Society of Edinburgh Dr. John Murray communicated the results of his researches on the form, structure, and distribution of manganese nodules in the deep sea.

He found that, as a rule, the nuclei of these nodules consisted of fragments of pumice stone; but that shark's teeth, earbones of whales and fragments of rocks not infrequently supplied their place.

He found them in the greatest abundance in deep water where organic life was scarce, whereas in the waters in which shore deposits are being laid down and in which organic life is the greatest, they were found to be of comparatively rare occurrence.

There is some difference of opinion as to the causes that have led to the formation of these nodules. Dr. Murray, however, expresses an opinion that the manganese has been deposited from solution in the sea water by way of the carbonates.

It is interesting to note that similar manganese nodules are often met with in the Malta "Globigerina Limestone" (Bed IV). There are several very fine specimens in the Malta University Museum.

The Subterranean Treasures of Italy.

("I Tesori Sotterranei dell'Italia", per il Cavaliere Guglielmo Jervis, Conservatore R. Mus. Indust. Ital. F.G.S., &c.) is the title of a most valuable and interesting work, in four volumes, which has just been acquired for the Malta Public Library. Vols. I to III treat of the topographical mineralogy of Italy; and vol. IV treats of its economic geology.

The fourth volume, especially, is full of matters of such interest to the man of science and to the general reader, that a brief description of it will, no doubt, be of some service in indicating the scope of the subject and the mode of its treatment.

The kingdom is divided into three main divisions viz. "The Alps," "The Appenines" and the "Islands of Sardinia and Sicily," each of which is worked out with great minuteness of detail with reference to its mineral waters, fossil fuels and economic rocks.

A description of the geological features of each district is given, and the economic value of the various rocks of which the strata are composed, is noted with reference to their suitability for building and decorative purposes, and for the manufacture of cements, stucco, lime &c.

Descriptions and illustrations of the kinds of stone used by the Etruscans & Romans, by the Greek, Egyptian, Phœnician and Pelasgian colonists of Southern Italy and by their modern descendants, in the construction of their temples ond other public edifices, occupy considerable space; and this, together with the interesting descriptive notices of the classical antiquities of the erst while mistress of the world, form a section, that will be of absorbing interest both to the classical, and the scientific scholar alike.

Directions as to the routes to the localities in which the economic rocks may be studied to the best advantage are given.

Of these Carrara, Rome, Tivoli, Naples, Syracuse and Sardinia are specially mentioned.

Pages XI-XIV are taken up with descriptions of the materials used in the construction of the principal monuments of Rome's former glory.

From these we select the following:

Roman amphitheatre at Verona made of compact Jurassic marble; the Pantheon at Rome, with granite columns; the cathedral of Milan, of pre-paleozoic marble; pavement of the "Via Appia" of post pliocene basalt; the baker's house at Pompeii with mill stones of late Tertiary leucitic lava.

Then follows a list of the names of the Authors who have written works descriptive of

the economic rocks of Italy; and a brief exposition of the geological principles that should underly works of this description is given. The nature of the various cements &c. are then entered into, and the lithological characters of the various kinds of stone are described. The work is profusely illustrated, with cuts representing the antiquities of the kingdom, and the regions from which the principal building stones are obtained.

The work has now been 30 years in course of preparation, and the information that it contains is of so valuable a nature that a copy of it has been ordered by the Italian Government for every public library, and every Chamber of Commerce in Italy.

It is also to be found on the shelves of most of the principal institutions of Europe, for it is indispensable alike to the scientist and the capitalist.

African Earthworms.

The last Kew Bulletin contains a report by Mr. Alvan Millson, the Assistant Colonial Secretary of Lagos; on Yoruba Land, the native territory adjacent to Lagos. After describing the wasteful system of cultivation employed by the natives and the wonderful rapidity with which the soil recovers from it, he says the mystery is solved in a simple and unexpected manner during the dry season. The whole surface of the ground beneath the grass is seen to be covered by rows of cylindrical worm casts. These vary in height from a quarter of an inch to three inches, and exist in astonishing numbers. It is in many places impossible to press a finger upon the ground without touching one. For scores of square miles they cover the surface of the soil, closely packed, upright, and burnt by the sun into rigid rolls of hardened clay. The rains ultimately break them down into a fine powder, rich in plant food and lending itself easily to the hoe of the farmer. These casts are very different in form from those which are common in English gardens. On digging down, the soil is found to be drilled in all directions by a countless multitude of worms drills, while from 13 inches to 2 feet in depth the worms are found in great number in the moist subsoil. It is impossible to estimate their number per cubic foot, as the quantity varies according to the season and the locality. Having carefully removed the worm casts of one season from two separate square feet of land at a considerable distance from one another, and chosen at random, Mr. Millson found the weight to be $10\frac{3}{4}$ pounds in a thoroughly dry state. This gives a mean of over 5 pounds per square foot, and a total of not less than 62,233 tons of subsoil brought to the surface on each square mile of cultivable land in the Yoruba country every year. This work goes on unceasingly year after year, and to the untiring labors of its earthworms this part of West Africa owes the livelihood of its people. Where the worms do not work, the Yoruba knows that it is useless to make his farm.

Estimating 1 square yard of dry earth by 2 feet deep as weighing half a ton, there is an annual movement of earth per square yard of a depth of 2 feet amounting to not less than 45 pounds. From this it appears that every particle of earth in each ton of soil, to the depth of 2 feet, is brought to the surface once in twenty—seven years. If seems more then probable that the comparative freedom of this part of West Africa from dangerous malarial fevers is due, in part at least, to the work of earth worms in ventilating and constantly bringing to the surface the soil in which the malarial germs live and breed. From specimens which Mr. Millson has sent home it appears the worm belongs to a new species of the genus *siphonogaster*. The type of the genus has been quite lately described from the Nile mud. Sci: Amer:

Deep Sea exploration in the Mediterranean.

The investigations which the expedition sent out by the Vienna Academy of Sciences has been carrying out in the eastern portion of the Mediterranean have been very successful. The investigations concerning the depth and general characteristics of the sea, and the presence of life in it, were carried out at seventy two distinct points. The greatest depths. (3700 metres, or over $2\frac{1}{4}$ miles), were found near the great depression

which runs between Malta and Cerigo—a deep valley running in a direction from north to south, and with a depth varying from 3500 to 4000 metres, the descent being much more abrupt on the Greek side than on the Italian and Sicilian side. Experiments as to light showed that the waters are more transparent near the African coast than in the northern portions. There, white metal plates were discernable at a depth of nearly 144 feet. Sensitive plates were still found capable of being acted upon by a light at a depth of nearly 550 yards (2 ¼ furlongs), at a point 200 marine miles north of Ben-Ghazi; on being drawn up they were found to have been blackened.

The acid constituents of the sea-water seem to be the same at the greatest depth as near the surface, nor is any difference in the quantity of the ammoniacal constituents perceptible between the upper and the lowest levels, with the exception that every where close to the bottom the quantity of ammoniacal ingredients is notable.

The deep sea region of the Eastern Mediterranean is very poor in animal life. A dredge at a depth of 3000 metres brought up no animal specimens at all, but at a depth of 2000 metres leaf-formed algœ were discovered similar to those found at the same depth in the Atlantic by the Panton expedition. *Sci. Gos.*

Formation of Coral reefs in recent seas.

The question of the origin and nature of coral reefs was fully discussed by Dr. John Murray at a recent meeting of the Royal Society of Edinburgh.

He first referred to the experiments that have recently been made with reference to the secretion and solution of carbonate of lime. He said that carbonate of lime remains are found in great abundance at the sea bottom in shallow waters, but the amount steadily diminishes as the depth increases, until at 4,000 fathoms almost every trace has disappeared.

This is due to the solvent action of the water as the organisms slowly fall to the bottom. Everywhere within 500 fathoms of the surface the ocean teems with life. The Greely expedition was starving within ten feet of abundant food, which might have been obtained by breaking a hole through the ice and using a shirt as a drag-net.

Dr. Murray then proceeded to discuss his theory of the formation of coral reefs, bringing forward, in reply to objections by Dana and others, some recently obtained facts regarding the existence of shallow regions in what is, on the whole, deep water. He showed that carbonate of lime is continually produced in great quantity in warm tropical water by the action of sulphate of lime in solution on effete products.

This explains the great growth of coral on certain shores in tropical regions.

The absence of coral on certain shores in tropical districts is explained by the uprise of cold water due to winds blowing offshore.

The paper was illustrated by an elaborate series of lime-light diagrams.

Notes on the discovery of a "Pleistocene Bed" at Gozo.

In the year 1874 a letter signed by Messrs Fielden and Maxwell appeared in the Maltese Journal "Il Barth," in which attention was drawn to a post-pliocene deposit, that was said to have been discovered in the vicinity of Cala Duera and Il Kala in Gozo. A specimen of the deposit together with a number of shells that were found in the bed, were forwarded to Prof: Seguenza, who, after having examined them, expressed an opinion that the discovery was one of much importance. (1)

From that time to this, no further attention appears to have been paid to the matter. During the latter portion of the summer of 1890, while engaged in investigating the geology of the Dueira district, I first discovered evidences of the bed to which Messrs Maxwell and Fielden had alluded seventeen years before.

Cala Dueira is a small bay, which is situated at the western extremity of Gozo.

Its southern and eastern shores are bounded by mural cliffs of Lower Coralline Limestone, that tower above the level of the sea to a height, which varies from 150 to 200 feet. (2)

In consequence of a fault, that extends from Monsciar at the head of Uied-el-Arab to Dueira, the eastern boundary of the bay has been let down,

(1) Il Barth. 1874.

(2) The following table shows the order in which the Maltese formations occur.

Dr. Murray's classification.	Capt. Spratt & Dr. Adam's classification.
I. Upper Coral. Limestone	I. Upper Coral. Limestone
II. Greensands	II. Sand bed
III. Clay beds	III. Marl beds
IV. Globigerina Limestone	IV. Freestone
V. Lower Coral. Limestone.	V. Lower Limestone.

and the cliffs are, therefore, no more than 20 feet high in some parts, while, towards the west, the strata shelve gradually off and finally disappear in the sea.

At the mouth of the bay there is an outlier of the Lower Coralline Limestone, which is known as the Fungus or General's Rock.

It was once, apparently, a continuation of the now depressed northern boundary.

The bay itself forms the embouchure of the Dueira valley, the catchment area of which is bounded on either side by a fault of considerable magnitude. That on the northern side extends from the General's Rock to the northern base of the hill known as Ghar-Ilma. The down-throw that has resulted from this fracture has depressed the area to the south of it to about 40 feet below the top surface of the Lower Limestone escarpment, which lies exposed along the line of fault.

The fault on the southern side of the bay extends from Dueira, via Monsciar to Miggiar Scini, and the result of its fracture has been to depress the area to the north of its line. The accompanying map will show the relative positions of these two faults, and the effec they have had on the area that lies between them.

The strata, that have thus been let down, are much broken and displaced; and, on the southern slope especially, there are several minor faults all of which trend in a direction that is at right angles to the main fracture.

The beds on both sides of the valley slope at varying angles, in many cases the inclination being as much as 45° and even 60° out of the horizontal.

The beds dip inwards; and the result of the synclinal, which has thus been formed, is the Duera valley, the bed of which is represented by the trough of the syncline.

The southern slopes are very uniform in outline; but those on the northern sides are divided into a series of smaller valleys or gullies, down which miniature torrents pour their waters for a few occasional hours in the winter time.

The deposits of which the sides of the valley are composed do *not* consist of the Lower Coralline Limestone (Bed V) as is represented in the geological map of the Island, which was published by Ducie, Spratt, Adams, and Murray.

The Lower Limestone is entirely absent save where it is exposed along the lines of faults that bound the valley.

The bed and sides consist of representatives of all of the formations that are to be found interstratified between the Upper and Lower Coralline Limestones in other parts of the island viz. the Globigerina Limestone, the Marl and the Greensands.

The Globigerina bed is the predominant rock; but both the blue and yellow clays and the Greensands are found in abundance along the Southern slopes.

Fringing the upper portion of the sides of the valley the Lower Limestone may be seen marking the line of fault with the Globigerina beds of the undisturbed district above, and those of the depressed area beneath it.

The former relation that existed between the depressed area and its surroundings is therefore distinctly apparent.

I have entered thus into detail because some misapprehension appears to have formerly existed with reference to the geology of this part of the island. Instead of being a valley of erosion similar to the Kaura, Scini, Sclendi, Asel, and Zebbug gorges, it is simply a depressed area, which has been let down by the dislocation of the strata on either side of it.

It is also important that these details should be carefully noted, as on their correct representation depends the proofs that much be adduced for proving the relationship which formerly existed between the Pleistocene deposits found in the valley below the line of fault, and those found on the summit of the slopes above it.

It was while engaged in noting the points of difference between the geology of the district as it is represented on Ducie's map, and that which actually exists, that I first came across the Pleistocene bed which I am about to describe.

Starting at the head of the valley and proceeding towards its mouth, the Globigerina strata will be seen sloping down the valley side, at angles of varying magnitude, and breaking off abruptly towards the lower edge they form cliffs of from

10 to 15 feet in height. Fringing the slopes that lie beneath these escapments, there is a bed of yellowish grey loam. The deposit may be traced for some distance down the valley; but in some places, owing to the denuding action of several small streams that have cut their way through it, it will be found to occur in patches only. It is situated at a height of from 20 to 30 feet above the present bed of the valley; and it extends east and west for a distance of about 30 yards, and north and south for about 15 yards.

It is lenticular in shape, but breaks off abruptly at the lower side, and an escarpment is thus formed which shows the maximum thickness of the bed to be about 7 feet, while at the extremities it thins out to 18 inches and a foot.

Its upper surface is extremely hard; and, like the surfaces of the surrounding strata, it has been much honeycombed and otherwise weather-worn.

Map of the south-western extremity of Gozo.
— — — — — — — — Faults.
A. A. A. Pleistocene beds.

The materials of which it is composed are very uniform, both in general appearance and in arrangement. They consist for the most part of fine detrital matter, the product, apparently, of the erosive action of atmospheric forces on the Upper Coralline, the Greensands, and the Globigerina beds.

The deposit is divisible into two well marked zones, the most persistent features of each of which are the irregularity of its divisional planes, and its non crystalline character.

The top zone consists of an impure, imperfectly formed limestone of a whitish colour; and it is usually overlain by a thin stalagmitic layer of about one inch, or less, in thickness. A chemical analysis shewed a sample of this part of the bed to consist of 80 % of carbonate of Lime, the remaining 10 % being made up of quartz, glauconite & alumina.

In many parts of the bed, minute tubular perforations are noticeable traversing the rock in all directions.

They vary considerably both in length and in the diameter of the bore.

None of them exceed $\frac{1}{16}$ of an inch in diameter, while many are much less.

These capillary tubes often play an important parts in determining the direction in which the rock cleaves.

They are, however, not persistent throughout the formation, and are more numerous in some parts of it than in others. This upper division is very fossiliferous, but, owing to the imperfect character of the rock, the mammalian remains that occur are seldom found in a perfect condition; and even when found entire, they are often so rotten that they crumble to pieces under the slightest pressure.

Besides large quantities of land-shells and mammalian remains, the teeth and vertebræ of sharks, echinoderms, several species of corals, and other representatives of a marine fauna occur.

All of these latter have, however, been derived from the Globigerina Limestone.

The following is a list of the organic remains that I found in this bed.

MARINE

Two teeth (Oxyrhina hastilis), } much waterworn
One tooth (Oxyrhina xipodon), }

Both of these species are characteristic of Beds 2, 3 and 4.

Water worn specimens of Flabellum, Zoantharіæ, and Corallines

One echinoderm (Brissus sp).

All of these had, evidently, been derived from Bed IV.

LAND SHELLS:—

Helix vermiculata. (Common)
Helix aspersa. „
Helix sp.? Very common.
Helix candissima.
Helix sp.?
Cyclostoma sp.?
Bulimus decollatus.
Bulimus sp.?

MAMMALIA:—

Teeth, bones, and horn cores of ruminants.

These were sent to the British museum: but in consequence of their bad state of preservation they were pronounced to be undeterminable.

FORAMINIFERA:—

In the washings of about two pounds of the material, the following species were observed.

Orbulina universa. d'Orb.
Globigerina bulloides.
Cristellaria sp.?
Clavulina cylindrica. Hantken.
Truncatulina ungeriana. d'Orb.
Nodosaria sp.? several broken.
N. „ oblique-striata, Reuss, broken.

Many fragments of others.

These also have, apparently, been derived from Beds II. III. & IV.*

Of the land shells the most numerous are those belonging to the Helicidœ. The specimens are generally in an excellent state of preservation; in some cases, even the original colour of the bands is preserved. The most numerous are the shells of a minute Helix sp.?

Next in descending order occurs a layer of yellowish-grey loamy earth, but the transition between it and the overlying limestone is so gradual, as to render it a matter of considerable difficulty to determine where the one ends and the other begins.

This loam is non-plastic and is very homogeneous. Being of a loose texture it easily disintegrates; and thus large portions are constantly breaking away and strewing the slopes with their debris.

Like the overlying limestone, this loam abounds in fossil landshells; but no mammalian remains appear to be present.

Water-worn pebbles of all shapes and sizes occur interspersed throughout every part of the formation; but though they are more numerous in the loam than in the indurated rock above it, they are, in the aggregate, much smaller.

An examination of a number of these pebbles shows that they have been derived from the three great limestone formations of the islands, (Beds I. IV. & V.) in approximately the following proportions:—

Bed I.	Upper Limestone	10 to 15 %
Bed IV.	Globigerina Limestone	50 to 70 %
Bed V.	Lower Limestone	20 to 30 %
	Black Limestone	10 to 15 %

All of these pebbles are much harder than the rocks from which they have been derived; and, when broken, they usually present the appearance of being surrounded by a hard external ring of rock of a semicrystalline character, within which is encased a nucleus of limestone that is similar in every respect to the beds that are in the immediate vicinity.

This change in the external part of the pebble is apparently due to the infiltration of limewater, the lime of which has been deposited in the interstices of the stone in consequence of the evaporation of the water; and thus the stone has been rendered more compact and of a closer texture than when the water was first absorbed in it.

The same phenomenon is observable whereever the Limestone beds of the Maltese series crop out as a surface deposit. Another feature of this Pleistocene formation is the extraordinary quantity of black limestone pebbles that abound in it.

Notwithstanding a diligent search in the district around, I was unable to discover any traces of a formation that possessed the same

* *Notes on the Malta Marl by J. H. Cooke "Il Naturalista Maltese" April 1891.*

lithological characteristics as are exhibited by these pebbles. Their origin is, therefore, at present a mystery.

Proceeding down the valley in a westerly direction, four mounds of blue and yellow clay, (the marl beds of Spratt, and Adams), are to be seen resting conformably on the southern slope at an elevation of about 20 feet above the bottom of the valley; and in two instances patches of the black and yellow sands, that are invariably found to overlie the marl formation in other parts of the island, are also present.

On the summits of these clay heaps there occur other portions of the Pleistocene bed; but unlike those that have just been described, they are not *in situ*, but have been formed apparently by the degradation of beds that were originally situated higher up the slopes.

The materials of which they are composed appear to differ but little from those of the other portions of the bed, save in the total absence of perfect shells, and in the comminuted condition in which the fossil bones are found.

Such are the principal characteristics of the Pleistocene deposits that are found along the southern slope of the Dueira valley.

If now, the road which winds up the hill-side towards Gebel-ta-Ben-Giorgio be traversed, the observer will pass from the Globigerina Limestone of the depressed district, across the line of fault marked by the Lower Limestone, to the Globigerina above it.

On the right hand side of the pathway that runs through this elevated region, and at a distance of about a quarter of a mile from the village of S. Giorgio another remmant of the bed is to be seen.

Descending the hill again, and crossing to the northern slopes similar accumulations of even greater extent are to be met with.

These portions of the beds, however, present many striking points of dissimilarity to those that we have just noted on the southern sides of the valley.

Like the deposits on the opposite slopes they extend in an East and West direction, and they lie unconformably on the Globigerina Limestone.

They occupy a kind of platform on the hillside; and, towards the lower boundary they break off and form escarpments of from 6 to 8 feet in height.

The section may be thus divided.

A. A greyish non-crystalline, slightly indurated limestone. Helices and other land shells occur in abundance; but no mammalian remains are present.

B. Limestone of a similar character to A, interstratified with irregular layers of stalagmite. These layers vary from $\frac{1}{4}$ to $\frac{1}{8}$ of an inch in thickness.

C. A layer of boulders and pebbles, all of which have apparently been derived from Beds IV. and V. Some of the boulders measure 18 inches and 2 feet in length; and all of them are rounded and otherwise much waterworn.

D. Loam intermixed with great quantities of smaller pebbles are found in this seam in great abundance.

E. A yellowish grey loam, similar in every respect to that which occurs at the base of the other deposits. It also abounds with land-shells, but no mammalian remains appeared to be present.

The distinct evidences of stratification that are apparent in the deposits on both sides of the valley, afford unequivocal proofs of their æquous origin; and this conclusion is still further borne out by the rounded and otherwise waterworn state of the pebbles that occur so plentifully in them.

The finer detritus, the pebbles, the shells, and the mammalian remains have all, apparently, been collected from the surfaces of the surrounding country by the agency of freshets and inundations of a similar character.

That no ordinary floods such as now occasionally occur in the winter time could have been engaged in the work of erosion and transportation is demonstrated not only by the contents of the beds themselves, but also by the nature of the gorges that have been cut in the strata in the immediate vicinity. Of these the Kaura gorge, a deep and rugged valley of erosion, is a striking example, the character of which points to the former existence of a much greater catchment basin than that which now exists, and to climatal conditions that must have been in direct variance to those that now endure.

What the origin of the torrential volumes of water was, that thus denuded down the face of the country I have not now the opportunity of discussing.

It would seem, however, that at the time that these deposits were laid down, Gozo greatly exceeded its present limits, and that it was watered by rivers of considerable volume. Indeed it is not improbable that the Maltese Islands then formed a part of the continent of Europe, and that these beds were deposited by the freshets that periodically deluged the country in consequence of the melting of the snow-fields and of the *mer de glace* that then occupied the greater portion of the continent of Europe.

J. H. Cooke

NOTES AND NEWS.

To the first part of the current volume of the Quarterly Journal of the Geological Society of London Mr. A. W. Waters, F.G.S., has contributed an excellent article on the *Bryozoa of Northern Italy*, in which he has added considerably to the results that have already been obtained by Reuss, Gottardi, Suess, and others who have worked on the same subject.

The specimens that he has figured and described were collected by himself from localities in the Vincentine, at Val di Lonte, Montecchio, Maggiore, Brendola, Malo and Priabona; and also from near Ferrari di Monte Baldo. The paper is illustrated with four well executed lithographs.

Professor Strüver lately announced, in a communication to the Academy of the Lincei, that he had detected the presence of the mineral *Brookite* in the earth of some caves near Beura in the Ossola valley.

His discovery is of much interest, as, hitherto, the presence of this mineral in Italian strata has been unknown.

At Mont Dol in Brittany a remarkable discovery was lately made in a surface accumulation that extends over an area of about 1900 square metres.

The teeth and bones of nearly one hundred elephants were exhumed, the latter of which were found to be much broken and charred.

The matter is now engaging the attention of several able geologists and paleontologists, as, judging by the condition of the splintered bones and their surroundings, some important evidences, having reference to prehistoric man, are expected to be forthcoming.

In the number of "Nature" dated March 26th 1891 there is an interesting biography, and an excellent engraving of the great French savant L. Pasteur.

In the January number of the "Neptunia" an Italian zoological magazine published at Venice there is an interesting article on the zoological work that has been done in the marine laboratory of Luc-sur-Mer in Normandy.

This station owes its origin to Prof. Deslongchamps of the Faculty of Sciences at Caen, who established it in 1883. During the seven years that it has been in existence it has been successively under the direction of Profs. Delage and Laffine by whom much valuable work has been done, the results of which have appeared in the Transactions of several of the French scientific societies.

Among the many articles that have already appeared we note a memoir "On the organization of the Chœtoptera" by Prof. Laffine; "Researches on the sponges of the Manche" by M. Topset; "On the Inkbag of the Mollusca" by M. Letellier, and an account of the work that is being done at the zoological station at Rapallo.

In the Quarterly statement that has just been issued by the Palestine exploration fund there are two papers that are of special interest. The one on land tenure, and agriculture in Syria and Palestine by the Rev. G. E. Post, and the other by Mr. James Glaisher F. R. S. in which a comparison between the highest and lowest temperature of the air, and the range of temperature in England and Palestine during the last ten years ending 1889, is given.

At the last meeting of the Entomological Society of London a paper was read by Mr. G. C. Champion entitled "On the Coleoptera collected by Mr. J. J. Walker R.N. in the neighbourhood of Gibraltar, with descriptions of new species."

Exchange Column.

Notices are inserted in this column free of charge. We request that all exchanges may be signed with name (or initials) and full address at the end.

I am desirous of exchanging minerals from Vesuvius, Ischia, and the Phlegrœan Fields, for mi-minerals of any kind, and igneous, or rare and uncommon metamorphic rocks. (Standard size for rocks is 10 × 12 centimetres). I also wish for photographs or pictures of physical geology and especially of Volcanoes and volcanic rocks, and can offer in return photographs of Vesuvius, of the Naples volcanic district, and of Iceland.

I can offer my own publications on Vulcanology and Seismology, for others.

Dr. Johnstone-Lavis, 7 Chiatamone, Naples, Italy.

TO LET.

THE

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CONTENTS.

NOTICES.

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Subscriptions are now due.

Special Notice to Readers.

We shall be much obliged to those readers who will send us the names and addresses of the Libraries and Museums at which the "Mediterranean Naturalist" is not yet taken.

Assistance of this kind will not only be the means of increasing our circulation, but it will also enable us the sooner to arrive at the time when we shall be in a position to illustrate the pages of each issue, and we trust, ultimately increase their number.

To Correspondents.

All communications intended for insertion should be written on one side of the paper only; and should reach the Editor on or before the 12th of the month. Whenever an answer is required through the post, a stamped and directed envelope should be enclosed.

Secretaries of Societies are invited to forward us reports of their proceedings; and Curators of Museums will confer a favour by informing us of any new and important additions that may be made to their collections.

Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

A retrospective periplus of the Mediterranean Sea

Let us go round,
And let the sail be slack, the course be slow,
That at our leisure, as we coast along,
We may contemplate, and from each scene
Receive its influence.....

Rogers.

Ages ago, long run out—so we learn from geological research—the Mediterranean sea was incomparably larger than at present, forming an immense ocean, communicating eastward through the Black Sea and the sea of Aral, besides occupying a vast tract of Central Asia to the confines of Bokhara.

Together with the Red Sea with which it was then united, it washed the north-west shores of the largest island in the globe, but which, owing to the subsequent accumulation of blown sea-sand, now forming the isthmus of Suez, was eventually joined on to Asia; while, from the gulf of Cabes in close proximity to Malta, a magnificent arm of the sea washed the southern shores of a long sub-tropical island, now united to the main land and constituting Morocco, Algeria, and Tunis, and covering the greater part of Northern Africa, opened out free communication from Egypt to the Atlantic between Senegal and Morocco.

But having successively lost in pristine extent, as if in a sulky fit, it seemed determined to leave indelible traces of desolation, if not of actual curse, everywhere behind in the form of its desert sandy bottom, where to this day no vegetable or animal life can find subsistance where the hurtful sirocco and typhoon originate, and where water, the universal blessing of nature, is unknown alike to the heavens above or on the earth beneath. Moreover, the sub-tropical climate of its northern shores became considerably lowered, and snow for the first time appeared on the mountain tops, the types of animal and vegetable life undergoing profound changes.

To some persons th
Naturalist may sou- .e title of *Mediterranean* to a publicatior .ad strange, not to say unsuited language. T" ., especially one in the English may be .nat such an indea is greatly hazarded curso- confidently proved from the foregoing p- .y remarks, and it is to be hoped that in the .ar future the readers may realize that innumerable subjects of the deepest interest fall directly within its sphere of action, and that they may be led to pay greater attention to the study of natural objects and phenomena, many of which have probably passed before them, perhaps without due observation, and consequently without having afforded them either pleasure or profit. To the Naturalist the noblest study is certainly that of man himself, and in opening up this periodical, to him let us dedicate a few rapid reflections.

The very name of *Mediterranean Sea*, of which we propose to make a retrospective periplus, or circumnavigation, is enshrouded with a continuous throng of unparalleled historical associations, which go far back into the hazy past, blending on the one hand with the mythological lore of Eastern civilization, as handed down to us through the elegant verses of the Greek and Roman poets, and on the other the still remoter horizon of the inspired history of the Semitic race, which settled on its eastern shores shortly after the deluge and whose characteristics, habits, occupations, aspirations, religious faiths are so vividly portrayed in the bible, that the more we learn of that ancient people the more we are struck with the photographic accuracy of the description, and the more we sympathise with them in all their troubled history, for to them we owe an unparalleled debt of gratitude.

At present the Mediterranean sea forms the boundary between civilization and barbarism, and, sad to say, Tripoli, Tunis, Algeria Morocco play a very insignificant part in the history of the world.

"Alas! how often have ruthless scimitars
Flashed through the lattice, and a swarthy crew
Dragged forth, ere long to number them for sale,
Ere long to part them in their agony,
Parent and child ... ...
... ...
But when, ah when, do they that can forbear
To crush the unresisting? Strange that men,
Creatures so frail, so soon, alas! to die,
Should have the power, the will to make this world
A dismal prison house, and life itself,
Life in its prime, a burden and a curse
To him who never wronged them? Who that breathes
Would not, when first he heard it, turn away,
As from a tale monstrous, incredible?"

ROGERS.

Yet Carthage once ruled with powerful sway; and we have seen how, still before that time, over the trackless wastes of the Sahara rolled the waves of the sea. Our century of boasted progress must needs make up earnestly for loss of time if she will aspire to the glory of bringing the swarthy sons of the still Dark Continent within the pale of civilised nations, to enjoy like liberty and good government with ourselves.

Sailing eastwards we come to the land of the Nile, ever symbolized by the sphynx and the hieroglyphs: the land of mystery and paradox, whose everlasting monuments are of unrivalled massiveness, whose sons have smarted under the merciless oppression of others, as they unmercifully oppressed, and who of yore mummified with equal religious care the corpses of their sovereigns, of their priests, and of their cats! Here lordly Thebes once stood, but now vanished from the face of the globe; here stretched the land of Goschen, and behind it the ancient bed of the sea. Further behind is the scene of the miraculous passage of the Red Sea by the children of Israel, 600,000 men, besides women and children, in all some two millions of souls; while under those waves lie buried the mouldering skeletons of the whole Egyptian host.

But what a change the magic wand of Lesseps and his engineers has brought about here! He has almost restored Africa to the condition of an island, which it held in very recent geological times. Civilization, commerce, goodwill between man and man, now smoothly flow through those straits, and help to build up apace the golden empire of Greater Britain at the antipodes.

Thousands of years ago full many a walled city might have been espied from the eastern shores of the Mediterranean, for there lived the stalwart Philistine, of more than ordinary stature, a turbulant predatory nation, the terror of the children

of Israel, and one of whose kings, the giant Goliah, was killed by the smooth pebble from the brook slung by the youthful David.

Then there were the Hitites, a most extensive nation, which exerted so much power, and played such an important part in the early history of Palestine and the surrounding countries, but of whose own history we are only just beginning to learn some piece-meal notion through the search-light of recent explorations.

Nor must we forget the ever wandering sons of the desert, the descendants of Abraham and Ismael, and whose distinctive mark has been that, "their hand has been against every man, and every man's hand against them"— as, alas! it still too often continues to be.

It was in tents, often pitched within sight of the azure expanse of the Great Sea, that the grand old patriarch Abraham, after leaving his native land, Ur of the Chaldeas, for precisely 100 years ruled in primœval simplicity, his command being a law to all, his numerous retainers and their offspring forming much of a family with their lord, and, when necessary, going to battle with him against hostile chiefs.

It was the glorious region washed by the eastern skirts of the Great Sea which God swore to give to Abraham and his posterity as a reward for his obedience, promising to make his seed as the sand which was upon the sea-shore—where Abraham had doubtless often wandered—for number; and when after 400 years of captivity and durance vile in Egypt, when his descendants returned to take possession of the promised land, we find Caleb and Joshua ladened with the phenomenal cluster of grapes which told so plainly of the soil and the magnificence of the sub-tropical climate. But all of this is thrown into the shade by the grand scenes of the life, death, and resurrection of Christ, which took place on the borders of the Mediterranean, from whose stormy crest the apostle sailed, whose earnest teaching was to overturn the colossal pagan empire of Cœsar, and to declare the illegality of slavery.

Was it not when the waters of the Mediterranean rose above the everlasting snowy peak of Mont Blanc, Kasbek, and Ararat, that that most magnificent specimen of marine architecture, the ark, safely bore the priceless freight which served to link the antidiluvial world with our own, while on the subsiding flood shone forth in all of its prismatic effulgence the first rainbow of promise? Strange must the anomaly appear to Britons that such a keenly commercial people as the Jews, Noah's lineal heirs, should never have built a larger craft to float on the waters than cockle-shell fishing boats such as those on the Lake of Galilee! Not so their immediate neighbours the Phœnicians. Tyre early became the emporium of the civilized world: to her million merchant princes the Mediterranean was the highway by which material prosperity, wealth, luxury, poured all of their resources into the lap of her citizens. From this port caravans of camels started for Assyria, Persia, Arabia, distant India: never of old were such untold treasures concentrated as there, or did such motley representatives of oriental races jostle each other as in her dingy, narrow streets eager to display her magnificence; nothing could become her pride but the purple-dyed silks and cloths which the Emperors of Rome long after adopted as the emblem of imperial majesty. Listen to the unmatched description given in the prophet Ezekiel, chap. XXVII.

"*Tyre situated at the entry of the sea; a merchant of the people for many isles which said, "I am of perfect of beauty; whose borders were in the midst of the sea, whose builders perfected her beauty, who made all her shipboards of fir trees of Senir, and took cedars from Lebanon to make masts for her. Of the oaks of Bathan did they make her oars, the company of the Ashurites made her benches of ivory, brought out of the isles of Chittion. Fine linen with braided work from Egypt was that which she spread forth to be her sail; blue and purple from the isles of Elishah was that which covered her. The inhabitants of Zidon and Arvad were her mariners; her wise men that were in her were her pilots; the ancients of Gebal and the wise men thereof were her calkers; all of the ships of the sea with their mariners were in her to trade in her merchandize. They of Persia, and of Lud, and of Phut were in her army, her men of war, they hanged the shield and helmet in her, they set forth her comeliness. The men of Arvad with her army were upon her walls round about, and the Gammadins were in her towers; they hanged the shields upon her walls round about, they made her beauty perfect.*

Tarshish was her merchant by reason of the multitude of all kinds of riches; with silver, tin, and lead they traded at her fairs. Javan, Tubal and Meshech were her merchants, they traded in slaves and vessels of brass in her markets: they of the house of Togarmah traded in her fairs with horses and horsemen and mules. The men of Dehan were her merchants; they brought her, for a present, horns of ivory and ebony. Syria was her merchant, and traded with her in emeralds, purple broidered work, fine linen, coral, and agate.

Judah, and the land of Israel were her merchants; they traded in her market, wheat of Minnith and of Pannag, and honey, and oil, and balm.

Damascus was her merchant for the multitude of the wares of her making, for the multitude of all riches, in the wine of Helbon and white wool. Dan also, and Javan, going to and fro, occupied in her fairs; bright iron, cassia and calamus, were in her market.

Dehan was her merchant for precious cloths, for chariots.

Arabia and all the princes of Kedar, they occupied with her in lambs, and rams, and goats, in these were they her merchants. The merchants of Sheba and Raamah, they were her merchants; they occupied in her fairs with chief of all spices, and with all precious stones and gold. Haram, and Canneh, and Eden, the merchants of Sheba, Asshur, and Chilmad were her merchants.

These were her merchants in all sorts of things, in blue cloths, and broidered work, and in chests of rich apparel, bound with cords and made of cedar, among her merchandise. The ships of Tarshish did say of her in her market, and she was replenished and made very glorious in the midst of the seas. When her wares went forth out of the seas she filled many people; she did enrich the kings of the earth with the multitude of her riches and of her merchandize."

Do not such such extensive and varied imports and exports seem almost comparable to those of the largest ports of the present day?

Proceeding to the north we reach the classic lands which have been the stage of full many of the noblest deeds of humanity, the birth-place of not a few men of transcendental wisdom; than which no other people ever possessed language so musically chaste and so expressive, art so refined, or edifices of such perfect taste and sublime proportions, the contemplation of whose mutilated ruins fill the cultured mind with mute delight.

"Fair Greece! sad relic of departed worth!
Immortal though no more; though fallen, great".

BYRON.

Here Alexander—meteor like—for a moment ruled the destinies of the world, and as immediately his colossal empire collapsed and fell to the ground.

Schliemann tells us that in excavating at Hissarlik he found the remains of one city under the other in repeated order each indicating the work of reconstruction after a terrible defeat and destruction, the older excavations bringing to light a civilization prior, by centuries, to that described by Homer.

But men of such primitive greatness knew nothing of the decrepitude of modern times, and were not to be baffled: they began again afresh, and the new city soon arose in all its splendour.

"Comes not a low whisper from the ground,
A sigh as though the immemorable past
Breathed here a long, slow breath?
Lost nations sleep below; an empire here
Is dust; and deeper, deeper still,
Dim shadowy peoples are the mould that warms
The roots of every flower that blooms and blows."

SHARP.

Both parts of the Austro-Hungarian Empire skirt the Adriatic shores whose few ports possess a primary importance for a great portion of Southern Europe. Placed in the vanguard of European civilization, the work of the Austrian government is peculiarly arduous, and the integrity of her territory is a pledge for the protection of Europe from the inroads of barbarism.

Here we have unified Italy, the outcome of Magna Grœcia, Etruria, Rome, and other illustrious predecessors; a land which has produced such men as Julius Cæsar, Augustus, Cicero, Virgil, Archimedes, Dante, Michel Angelo, Cavour, Garibaldi, Victor Emanuel. Rome once ruled the destinies of the world, but fell because her citizens could not govern themselves, enfeebled as they were through rapine, corruption, and effeminacy. Who shall measure the rivers of human blood for which Rome must one day answer; blood of massacred nations, blood of Christian martyrs?

The ancient history of Italy, presents wonderful events and great characters: we hail the phœnix like resuscitation after having been for centuries the *terre des morts*, and her consolidation under the wise sceptre of the House of Savoy was an unquestionable boon to Europe; nor need Italy return to the past, for under the inspiration of diffused education and civil and religious liberty, a far higher civilizaton is before her.

What colossal progress has not France made in the course of this century? Never let us forget what she formerly was, the unparalleled difficulties she had to contend with on account of repeated invasion of her territory, however true it may be that she it was who provoked it through fault of her own.

Yet her people have surmounted every barrier; their activity and perseverance are phenomenal: the manufactures, agriculture, and commerce of the country have developed in an incredible manner; within the memory of the inhabitants Paris, as well as all of the great provincial cities, have been rebuilt and modernized, and the port of Marseilles, with its cosmopolitan thousands, presents much analogy to that of Liverpool. But let it be confessed that the Frenchman, who takes more delight in the theatre and coffee house than in his home, is not a good colonist, nor ever will be until social welfare and order replace politics in his preoccupations, and until his habits become more domesticated.

Spain closes the periplus. The Phœnicians early knew her geographical importance, when they founded Gadiz (Cadiz) as the western port of call; Carthagena recalls Carthage; Palos brings back all our recollections of Columbus and his great Spanish protectors. Brilliant has been the history of Spain on several occasions; her people are chivalrous; her immense natural resources are still undeveloped, and the country which once stood before England as regards her colonies has need of closer contact with her northern neighbours, from whom she may yet learn some useful lessons, recognising, above all things that the Middle Ages are gone forever. But the Mediterranean is also studded with countless gems of various sizes in the shape of islands, and the little one in its very centre—Malta—may be considered the most precious of all!

TURIN, W. JERVIS.

The locust plague in Egypt & Algeria.

The raids made by the locusts on the sugar, maize, and cotton crops in Upper and Lower Egypt, Morocco, Algiers, and Tunis are now assuming most serious proportions, and have already caused irremediable loss both to the governments of the districts and to a large number of growers and mercantile firms.

No visitation for the past 40 years has created such widespread devastation, as has the present one. From the reports, that have been sent in, it seems that the principal part of the mischief is due to two species of the insect, *Acridium peregrinum* and *Stauronctus maraceanus*, the former of which is supposed to be the locust of the bible.

Both species periodically invade Algeria from the direction of the Sahara where they breed in the more barren and elevated parts of the desert. There, in the verdureless and friable soil, the female bores a number of small holes with her ovipositor, ands lays in them in agglutinated masses, the eggs, from which the coming generation is to be produced. As a rule the eggs take about one month to hatch. Upon emerging from the egg the young locust feeds voraciously upon whathever plant life may be within reach, and after about two months, it developes wings and migrates in swarms to other and more fertile regions.

The vigorous steps for their extermination that have been initiated by the Government and that have been carried out by the provincial Mudirs have this year been of but little avail, and it is feared that, unless more stringent and effective measures are adopted before next season, that the number of eggs that will have been deposited in the fertile regions, will be the cause of even a more serious visitation next year.

Recent researches of G. B. Schiaparelli made at Milan University.

Schiapparelli has overcome the difficulties of observing the rotation and physical condition of the planet Mercury, that are due to its proximity to the sun and to the fact that it can only be observed in full daylight and through an atmosphere

which is constantly illuminated. He carried out a continuous series of observations on the spots of Mercury by means of the new large refractor which has recently been installed at Milan. With regard to the rotation of the planet, he finds that the motion of Mercury round the sun is similar to that of our moon round the earth, and that it always presents the same hemisphere to the sun. It, however, possesses a greater "libration of longitude." Hence three-eights of the planet's surface is continually in the blaze of the sun, and an observer in this region sees the sun oscillate in the sky over an arc of 47°, the double oscillation taking a period of 88 earth-days. Another three-eighths of the planet's surface is turned away from the sun, and is consequently in continual darkness, being only illuminated by refracted rays and twilights. In the intervening tract of one quarter of the surface there is a single alteration day and night during each interval of 88 days, the length of the day and of the night varying at each place according to its position, but constant for the same place.

The possibility of the existence of organic life will depend upon the existence of an atmosphere capable of distributing the sun's warmth. Schiaparelli thinks he has discovered indications of an atmosphere in white clouds appearing as bright spots, and rendering the image of the spots indistinct.

He supposes the dark spots to be tracts of water, and these he finds are not aggregated into large tracts forming oceans, but appear to branch and ramify through the land as canals. Such an alternation of land and water he thinks would cause a more complete equilibrium of temperature. The peculiarity in the rotation of Mercury is an exception among the planets, but common among the satellites of the planets. Mercury has no satellite, so that it presents a remarkable divergence from the prevalent condition among the planets.

Natural Science in Tunis.

The scientific explorations of Tunis, since it came under the dominion of France in 1881, says the *Contemporary Review*, is apparently making good progress. Two volumes, dealing with some the results already obtained, have recently reached us, both of which are deserving of the attention of geologists. In one of them we have descriptions of a series of fossil mollusca, obtained from some of the cretaceous formations of the country, and in the other a set of plates illustrating a portion of the formations met with.

The specimens dealt with were collected in 1885 and 1886 in the region which lies to the south of the elevated plateau of Tunis, and from the standpoint of the paleontologist, are of considerable value and importance. In an introduction which precedes the technical descriptions, M. Peron briefly discusses the chief features of the cretaceous fauna of Tunis, lays down the principles which have guided himself and his collaborateur in the making and determining of species, and corellates his conclusions with those obtained from a study of the cretaceous rocks of other countries.

As might have been expected from the continuity and similarity of geological structure which they exhibit, Tunis and Algeria have a similar fossil fauna, and hence the work done on the paleontology of the latter country by M. Coquand has materially assisted the others in the task they have undertaken.

But while admitting to the full the value of the assistance rendered them by M. Coquand, both by his writings, and in other ways, we think they are justified in claiming the credit of having advance considerably beyond the position he attained, and of having introduced something like order into a subject which was somewhat chaotic. Here as in many other cases, species and genera have been founded on insufficient material; individual variations have not been allowed for, and the determinations of earlier investigators have been ignored. Hence the difficulties met with by the others in the determination of the species and the interpretation of their relations to previously described forms were both real and considerable. These difficulties were especially felt in dealing with the *Gasteropoda*, most of which had to be reclassified, even the generic character in some instances having been misconceived or confounded.

Perhaps the greatest service they have rendered to paleontology, however, is the great reduction they have been able to effect in the number of species of Ammonites, Plicatula and Ostrea, a

reduction which not only systematises simply and clearly the knowledge already acquired, but will greatly facilitate the progress of future investigations.

Some of these changes take effect in the volume before us, which embraces the Cephalopoda and the Gasteropoda, and the rest will, no doubt, be introduced in subsequent volumes.

Of the technical descriptions which make up the great bulk of the volume, we need only say that they are as full, as precise, and as vivid as could be wished, and include no useless or superfluous details.

The Oxycephalids by Carl Bovallius.

This exhaustive and elaborate memoir, written by the professor of Natural History in the University of Upsala constitutes an important addition to the literature on the Amphipoda.

From the introduction, we learn that the author had a two-fold object in view in thus publishing the results of his researches, the first in order that he might have an opportunity of stating his reasons for the systematic arrangment of the genera and species of the Amphipoda that he has adopted, and secondly in order that he might be able to commucate some fresh results that he had recently obtained.

The memoir is divided into four parts.

I. Historical notes on the Oxycephalids.
II. The systematical position of the Oxycephalids.
III. Morphological notes on the Oxycephalids.
IV. The Oxycephalidean genera and species.

The value of the work is still further enhanced by the profuse manner in which it is illustrated, there being 87 illustrations in the text, and 7 appended plates.

Preservation of the colours of plants.

BY G. D. DRUCE, M.A., F.L.S. *(1)*

One great complaint about dry plants is that the colour goes or becomes altered, but a great deal may be effected by careful drying.

My friend, Dr. Schonland, told me of a plan they had in the Berlin herbarium of dipping the specimen in three parts of sulphurous acid and one of methylated spirit.

The flowers are immersed until bleached, or in the case of white ones, from a few seconds to seven minutes, according to the texture of the flower; they are taken out, and the superfluous moisture allowed to be absorbed by a piece of bibulous paper, and then dried in the ordinary way. Gradually the colour comes back and is then permanent.

The rationale of the process appears to be this. The destruction or alteration of the plants colour in drying is probably owing to a ferment. We know that hay allowed to ferment or heat becomes spoiled.

So with herbarium specimens, overheating or allowing them to remain in damp papers is absolutely destructive to colour. Some colours appear to be especially fugitive or sensitive. Blues become brown, whites become brown or black, pinks change to brown, and yellow sometimes changes to green. Now, I take it, the sulphurous acid not only deoxidizes the colour, but, combined with methylated spirit, destroys the ferment. On exposure to air, or in process of time, the plant again becomes oxidized and the colour reappears. That the spirit may be useful in hardening the cell wall is also probable. There is some difficulty with flaccid flowers, for when dipped in the solution they become so pulpy as to render it very difficult to lay them out properly. Such specimens may be first put in parchment paper, and pressed in it.

It answers admirably for our Campanulacœ, Orchidacaœ, and also for the parasitic Cuscuta or semi-parasitic Lathrea, Bartsiana, and Orobanche.

My experience is that pink colours are generally darkened by it. I am told it answers well for the Cow-wheats and Asperula. My experience with the former is not as yet satisfactory. Care must be taken to use fresh sulphurous acid free from sulphuric. I have found that slight traces of the latter are sufficient to change delicate blues to pink, and thus to give false impressions.

(1) From a paper "The History of Botany—Herbaria" read before the Chemists' Assistants' Association London.

Phosphate Beds around London.

The news that reaches us from London of the recent discovery of valuable mineral deposits in the neighbourhood of Taplow, is but another example of the important part that scientific investigation plays in assisting to develope the internal resources of a country.

Deposits of phosphatic chalk have been found in the Thames Basin, and from the analyses that have been made, it would seen that they are as rich, if not richer in phosphoric acid than are the products of the French, and Belgian beds, that are so largely used in England for agricultural purposes.

Further investigations are now being made, and if the results are as good as are anticipated there is no doubt but that the discovery will lead to the establishment of a thriving industry in the district.

It is estimated that upwards of 40,000 tons of the mineral are imported from Belgium into England every year. How far this discovery will affect the foreign markets remains to be seen.

Discovery of Caves in Corsica.

At a distance of about 1¼ miles from Ponte Lecchia, in Corsica, a series of cavernous grottoes has been discovered that extends underground for a distance that has been estimated to be not less than 37 miles.

The entrance that leads to these subterranean galleries is very small, and difficult of access; but after entering, the galleries the passages widen out, and assume magnificent proportions, some of the caves being as much as 25 yards high. It is supposed that the galleries abut on the cliff face on the coast of Ravellata near Calvi, as the party that, undertook the exploration of them, frequently heard the muffled roar of the waves in the distance.

The exploring party was engaged for upwards of eight hours in the search for the farther extremity; but were unable to find it. Arrangments are to be made for a complete investigation of the caves.

The Gozo Pleistocene Bed. (1)

Mr. E. A. Smith, the President of the Conchological Society of Great Britain, has determined the shells found in the above bed (1) to be as follows.

Pomatias	melitensis	(Sow).
Helix	pisana	(Müll).
Do.	striata	(Drap).
Do.	vermicularis	(Müll).
Do.	virgata?	(Montague).
Do.	caperata?	„

NEWS OF THE MONTH

An earthquake took place at 2. 5. a.m., on the seventh of June in Northern Italy, the greatest intensity appearing to have been a little to the north of Verona as a centre.

The village which most suffered was Tregnago, situated a short distance to the N. E. of Verona. Here a large proportion of the houses were injured by fissures, to such an extent as to have rendered them unsafe to live in. Some damage was also caused to several houses in other places, among the rest at Verona, where it has been affirmed that the floating wooden mills on the Adige were momentarily stopped by the concussion produced by the shock. The earthquake region extended as far as Venice, Modena, Chiavari, Turin, Domodossola, etc. Beyond this the shokes may have been sensible to very delicate seismical instruments, though not sufficiciently strong to have been otherwise manifest; so that, as in the case of the West Alpine earthquake of 23rd. February, 1887, it is extremely problematic whether it had the remotest connection with any volcano.

Up to the present moment we have no news relating to the shock in the Tyrol or Switzerland, where it must also have been felt.

One person was killed and five others wounded by fall of houses. Two women died of fright—but that was not the fault of the earthquake.

The movement was undulatory and subsultory; no accounts received specify tho vorticose movement, characteristic of the focus of violent earthquakes, and which are so disastrous to buildings.

(1) Med: Nat: Vol. I. No. I. pag. 10.

Another earthquake shock was felt at 8. 30, a.m. on the 11th June, at Verona and elsewhere, especially at Tregnago and Baddia Calavena, at which latter place further injury was caused to the houses.

A series of articles on the Maltese Lepidoptera. written by Mr. Caruana Gatto, B.A. is now appearing in the Italian review of Natural Sciences.

Dr. Johnstone-Lavis, M.D., M.R.C.S., B. ès Sc. F.G.S., etc. of 9 Chiatamone Naples has again been entrusted with the work of writing the article on Vulcanology and Seismology for "l'Annuaire Gèologique Universel."

In order that the article may be made as complete as possible, Dr. Johnstone-Lavis will be glad to receive any memoirs on these subjects that may have been published of late. To facilitate the work of reference and to obviate the possibility of any important points being over-looked, he desires that authors will send him copies of any papers that they may have written on the subject, together with a summary of the contents.

A recent telegram from Algiers says that the French savant, M. Kunchel Herculais, the president of the Ethnological Society, who was employed on the Government mission of investigating the locust plague in Algeria, has met with a horrible death. While examining a deposit of locust eggs at the village of Sidierall, he was overcome with fatigue and the heat and fell to the ground. While sleeping he was attached by a swarm of locusts.

On awaking he struggled desperately to escape from the living flood. He set fire to the insect ladened bushes near him, but all of his efforts proved ineffectual, and when finally the locusts left the spot, his corpse was found. His hair, and necktie had been entirely devoured.

M. Herculais was a member of the French Academy, and the author of several valuable works on insects.

The Eruption of Vesuvius of June 7th. 1891.

During the latter part of last year and commencement of the present, the central activity has very slightly varied, except about the new year, when it was considerably increased, rising to the third or fourth degree simultaneous with the stoppage of the lateral outflow of lava that had been going on since August 7th. 1890. Since then up to the present outburst, the central activity has been generally at the first degree, and the cone of eruption has slowly grown in height.

On June 1st. there was a crater within the central eruptive cone of about 50m. in diameter near the centre of which was the eruptive vent surrounded by another embryonic eruptive cone. On that day four small eruptive mouths opened around the embryonic cone in the bottom of the central crater, the smallest being to the E.

Thus the volcano remained till June 7th. at 10 a.m. when activity stopped, only a small quantity of vapour escaping from central vents. At midday a radial cleft opened at the north toe of the cone of eruption (May 1889 June 1891) traversing towards its east end and the little sickle-shaped ridge, the remnant of 1885-86 crater. At 4 to 4 30 p.m. shocks of earthquake commenced, limited only to the upper slopes of Vesuvius and simultaneous with the extension of the radial fissure down the side of the cone for nearly half its way opposite the Punta del Nasone of Monte Somma from which, at about 5 30 p.m. issued a little lava, whilst from the upper extremity of the fissure at the toe of the cone of eruption much vapour issued so that from Naples the smoke plume arose from this point. From 5. 30 to 7 p.m. the fissure still extended lower, accompained from time to time by local earthquake, noises, and the elevation of columns of black dusty smoke. At a few muntes to 7, the floor of the Atrio del Cavallo was reached and a remarkably black column of smoke had arisen.

My friend Dr. L. Sambon saw this column arise and came to inform me immediately, as I had left off watching the mountain at 5. 30. After taking a photo of the mountain, we left Naples at 9 p. m. and spent some time in enquiries at Resina

and near the Observatory. Everything was now dark, as the mountain had calmed down at 8 p.m. At 2 a. m. June 8th, we were at the extremity of the Observatory ridge and commenced to wend our way across the lava surface towards Monte Somma. We were at the lowest part of the depression at the W. and of the Atrio del Cavallo where it joins the Fossa della Vetrana and along which some of the largest lava streams have flowed (1855, 1872, etc.) when suddenly on our right, above us (2. 23 a. m.) a vast quantity of bright red vapour arose from the new outpour of lava and which Illuminated all the wild crags of the inner walls of Monte Somma. We hastened our steps as much as the road and our lantern would allow us, so as to reach the escarpment of Monte Somma, the foot of which was followed till near the Punta del Nasone and close to the theatre of eruption. Here we clambered up some distance above the level of the Atrio to watch events whilst we ate our late supper or early breakfast. Along the slope of the great cone in the line of fissure were a few luminous points from a few pieces of still uncooled lava of the little that had oozed forth from the lower half of the fissure. At about 60 or 80 yards from the foot of the great cone two or three fountains of lava were throwing up jets of molten rock for 2 or 3 m. and the lava was slowly spreading out on the almost horizontal plain of the Atrio in several tongues. The lava must have still been high in the maim chimney, as the vapour that issued at the top of the fissure showed slightly the illumination. So we remained till daylight when we could see the fissure on the side of the cone. The mouth that formed at 5.30 the previous day was still smoking a little, whilst the fissure below it sent off several ramifications at an acute angle like the branches of an inverted tree from several of which, little streams of lava had been given out, where they had soon consolidated. We now followed the base of the great cone to the lower railway station, where we found all the people up and dressed, frightened by the strong shock and noises at 2. 23 a. m. coincident with the fresh outflow of lava that we had witnessed, but which shocks we had not felt, although they were described as the strongest that had occurred.

Having ascended the summit of Vesuvius we found the central crater rapidly enlarging by the falling in of its edges. From the new fissure at its summit was issuing much vapour under pressure, and so rich in Sulphurous acid as even in traces to be intolerable; and the hot air coming from innumerable new fissures rendered approach very difficult. We did in fact once jump across part of the fissure, but returned much quicker on account of the hot irritant vapours. An approach from the opposite side was equally unsuccessful. At some old fumaroles on the 1872 crater plain I collected some crust of Boric acid, and alum, both rare products at this volcano.

One of three terminations we may expect to these phenomena which are very characteristic of a lateral disruption so common at Vesuvius:

1st. Should the lava cool sufficiently to plug the radial dyke no further phenomena will occur, and activity will be restored to the central vent.

2nd. If this plugging only partially take place lava may dribble forth for months, but probably the escape of vapour will soon be restored to the central vent.

3rd. If the rent should widen, considering how low it extends we may expect a grand eruption which might rival that of 1872, which commenced near the same spot and much in the same way; the mechanism by which this occurs I have explained elsewhere. (1)

H. J. Johnston-Lavis.

Observations on the Geology of the Maltese Islands

BY JOHN H. COOKE.

The Maltese Islands have of late years occupied a considerable share of the attention of naturalists, and they are, therefore, by no means a *terra incognita* either to the botanist or to the geologist.

But while the botany of the Islands has been making most marked progress in the hands of the late Professor Gulia and his collaborators, the

(1) H. J. J. L. The Relation-ship of the Structure of Igneous Rocks to the Conditions of their Formation.— Scientif. Proceed. R. Dublin Soc. Vol. V, New Ser. pp. 112-156.

geology has been much neglected, and, until the arrival of Dr. John Murray of Edinburgh in the Springs of 1889-90, but little work can be said to have been effected for the last twenty years.

Among those who have been specially engaged on Maltese geology, the names of Spratt, Adams, Fuchs, and Murray, stand pre-eminent.

All of these workers have labonred during the last half century, and, therefore, the views that they have expressed, are more or less in accord with the latest theories of geological science.

But records show, that it was not in the present century only that observers had been attracted to, and had attempted some explanation of the physical phenomena of the islands. Dana(1) in his "Manual of Geology" notes, that in the year 1670, Scilla, the Sicilian painter, made several sketches of the remains of a huge carnivorous whale, *Zeuglodon*, that he had met with in the Maltese beds; these sketches Scilla(2) afterwards embodied in a work entitled "De corporibus marinus," a copy of which still exists in the public library of Valletta.

In 1647, Abela,(3) the Maltese historian, mentions the discovery of certain large bones, which he assumed to be the remains of a giant race of people that had formerly inhabited the Maltese Islands.

The size of the bones indicated an immense stature, and he therefore inferred that they were the remains of the fabled race known as the "Cyclops".

That such races had formerly existed was a common belief among all classes in the middle ages.

Mediæval literature teems with accounts concerning them, and, therefore, Abela's opinion was neither original nor singular. Cervantes causes his Don Quixote to tell us in one of his raphsodies, that, "In the island of Sicily, there have been found long bones, and shoulder bones so huge, that their size manifests their owners to have been giants; for this truth geometry sets beyond doubt".

And Lambecius, too, gives us a very quaint account of the manner in which certain savants of Constantinople sought to impose upon the Emperor at Vienna, by offering him, a large elephant's molar, which they asserted, had been found in the vicinity of Jerusalem. They represented this tooth as having formerly belonged to the giant Og, and in support of their statement, they averred that the cave contained a tablet bearing the Chaldean inscription

"Here lies the giant Og."

The folk-lore of India, China, Rome, Greece, and of all of those nations possessing an ancient liberature, abounds with myths having for their origin the colossal organic remains that have been exhumed from the strata: myths, that were the more readily accepted because they were often supported by the expressed opinion of the most eminent sages of the time. St. Augustine, speaking of the existence of man before the flood, refers to the physical degeneracy of his times, and leads his hearers to believe in the former existence of a race of men of gigantic proportions. He says, "I, myself, along with some others, saw on the shore at Utica a man's molar tooth of such a size that, if it were cut down into teeth such as we have, a hundred, I fancy, could have been made out of it". And Strabo, Pliny, and Herodotus, respectively, in their works, proffer similar opinions, concerning the origin of the colossal teeth and bones that had come under their notice.

During the period that elapsed between the issue of Abela's work and 1791, there are no records to show that any attempts had been made either to controvert or to supplant the theory that he had propounded.

In 1791, however, a writer named Dolomieu (1) came forward and in a work entitled, "Malta par un voyageur Francais," he not only entered into a detailed description of the Maltese strata, but he also attempted an explanation of the more striking of the physical phenomena connected with them.

The work contains much that is highly creditable to the intelligence of the author; but in consequence of the very incomplete state in which the science of geology then was, the deductions that he has drawn from his observations can now be considered as being of but little or no value.

(1) Dana Prof. J. "Manual of Geology" p. 169.
(2) Scilla "De Corporibus Marinus" 1670.
(3) Abela F. F. "Descrittione di Malta" 1647.

(1) Dolomieu "Malta par un voyageur Français" p. p. 74.

In 1843 the late Admiral (then Captain) Spratt commenced a series of investigations, which were conducted with such success, that the attention of several eminent scientists was drawn to the strata of the islands, and the stratigraphy and paleontology formed the subjects of several papers that appeared in the geological magazines of their times. (1)

Since then many new facts have come to light, the recording of which is necessary if the chain of evidences in the geological history of the Islands would be made complete.

My four years residence in Malta has given me an opportunity of not only examining those that have been recorded by other observers, but it has also enabled me to undertake a systematic examination of the island's geology, the result of which has been the discovery of several new and and interesting evidences bearing on their former physical history.

In the following papers I propose to give a brief account of these phenomena, and at the same time to add such other particulars relating to Maltese geology as will enable those interested in the subject to form a fair estimate of the present stage of the enquiry. *

The group, known as the Maltese Islands, consists of the islands of Malta, Gozo, and Comino, together with several barren, rocky islets of varying sizes, the principal of which are Filfola, and Cominotto.

They are situated in the Mediterranean at a distance of 60 miles to the south of Sicily, and 200 miles to the north of Cape Calipia, the nearest point in Africa.

On the north they are connected with Sicily by means of a sub-aequous plateau, the depth of submergence of which does not exceed 70 fathoms in any part; while to the south, a deep channel having an average depth of 230 fathoms, and which is 190 miles long and from 60 to 100 miles wide, forms a natural boundary between them and Africa.

Malta is the principal island of the group both in size and commercial importance. Its greatest length measured from the Marfa to Marsa Sirocco is 17 miles, and its greatest breadth is 10 miles.

Though less fertile than the sister island of Gozo, its population is nearly eight times as numerous. The causes that have given rise to this curious anomaly will be the more readily understood after a consideration of the distribution of the strata, and of their peculiar characteristics.

At the present time there appears to be some uncertainly as to which division of geological time the Maltese strata properly belong.

Spratt(1), and Adams(2) considered them as being of Miocene Age; but Jones(3) considered them as belonging to the Eocene. Fuchs,(4) the Austrian geologist, on the other hand refers the upper formations to the Miocene, and the lowest formation of the series to the Oligocene. Dr. John Murray,(5) while agreeing with the Fuchsian theory, points out the fact that a striking analogy exists between the microscopic sections of the Malta Globigerina limestones, and the sections of the Pliocene rocks of Sicily.

From several comparisons that I have made of the Malta Globigerina rock with the "Pietra Leccese" of Italy, and of the Malta marls with the clays from San Ruffillo near Bologna; and from a careful consideration of the evidences that have been adduced by other students of the strata, I am inclined to believe that the Fuchsian theory approximates more nearly to the truth than either of the others. Paleontologically the Maltese strata offer strong resemblances to the Miocene beds of Tournay and Brittany(4), to the Black Crag of Belgium, to the Miocene formations of the Vienna Basin, to those of Dego, Cal-

(1) See Proc. Geol. Soc. 1843, 1854, 1855, 1860, 1862, 1863, 1864, 1865, 1866, 1867, 1868, 1869, 1870.

** The following should be read in conjuction with these papers:—*

1. Pamphlet of the "Geology of Malta" by Capt. Spratt, R. N. 1854.

2. "Notes on the Nile Valley and Malta," by Dr. Leith Adams 1870.

3. "The Maltese Islands with special reference to their geological structure" from the Scottish Geographical Magazine, by Dr. J. Murray, Sept. 1890.

(1) "On the Geology of Malta and Gozo" by T. Spratt. Valletta 1854.

(2) "Malta & the Nile Valley" A. L. Adams. Edinburgh, 1870.

(3) "Fossil foraminifera of Malta" T. R. Jones. Geologist vol. VII. 1864.

(4) "Das alter der Tertiarschichten von Malta" Th. Fuchs. Sitr. d. K. K. Akad. der. Wiss. Wien. Bd. vol. XXII. p. 67.

(5) "The Maltese Islands" John Murray. Scot. Geog. Mag. Sept. 1890.

caire and Belforte in Italy, the marine Molasse of Hungary, the Sotska beds of Styria, the Pectunculus beds of Hungary, and the Miocene beds of Jamaica, Sicily(1), and Algeria.

The following table gives the order of superposition of the Maltese formations.

	Formation	Thickness	Sub-divisions	Localities for study
I	Quarternary beds	various	*a.* Alluvium *b.* Pebbles & gravels *c.* Ossiferous breccias. *d.* Valley drifts	The valley & plains Fom-ir-rieh and Mars-el-forn. Malak, Scirocco & Melleha. Dueira, Emtahleb.
II	Upper Coralline Limestone	250 ft.	*a.* Compact, white limestone of a breccia like texture. *b.* Soft, porous, red coralline limestone	Chambray & Melleha
III	Greensands	50 ft.	*a.* Compact, yellow sandstone *b.* Friable black sandstone	Dingli cliffs. Chelmus.
IV	Blue Clay		*a.* Yellow clay. *b.* Blue clay.	Gomerino. Ghain Toffiha
V	Globigerina Limestone	200 ft.	Variously coloured beds, interstratified with from four to six nodule seams.	Luca, Tignè, and Fom-ir-rieh.
VI	Lower Coralline Limestone.	250 ft.	*a.* Semicrystalline limestone *b.* Non crystalline limestone.	Ricasoli. Duera.

In the above table, I have adopted Dr. Murray's nomenclature.

The deposits thus arranged, may be divided into three groups. The first is composed of ossiferous breccias and valley drifts (3); and they are analagous to the Quarternary deposits of Nubia, Algeria, Candia, Sicily,(2) and Gibraltar.

The second comprises the various sub-divisions of the Upper Coralline Limestone, and resembles the Leith-Kalk of the Vienna Basin.

(1) Seguenza G. "Le formazioni Terzarie nella Provincia di Reggio (Calabria)" 1877.

(2) Falconer "On the fossil remains of Elephas Melitensis" Paleontological Memoirs Volume II. London.

(3) Cooke, J. H. Med. Naturalist, Vol. I. No. 1 page 7. June 1891.

The third group is made up of the remaining five beds, and answers to the Miocene beds, of Schio, Dego, Calcare, Mont Titano, and Belforte in Italy.

The general dip of the Maltese strata is in a north east and an east-north-east direction; but in some localities, it has been somewhat affected by faults and other local displacements. In Malta this dip is more pronounced than in Gozo, and, as a consequent result, the plysical contour of the northern coasts of the two islands presents some striking contrasts.

The strata of Malta shelve off at a low angle towards the north, and the shores, therefore, are lowlying and present a tame and monotonous aspect when viewed from the sea.

In Gozo the original horizontality is more or less preserved, and the coast line there consists of an unbroken series of precipitous cliffs, that impart to the shore line an effect that is at once bold and picturesque.

They are composed of the Lower Coralline Limestone, and, rising sheer from the depths of the sea, they tower at a height of between 300 and 400 feet above the Mediterranean waters.

From the edge of their summits and falling back in gently undulating curves, lie the Globigerina deposits, capped with the sombre coloured clays, and the golden-hued sand-stones, while, crowning the whole, lie the variegated strata of the Upper Coralline beds, the mural precipices and craggy escarpments of which, stand out in bold relief against the clear blue Mediterranean sky.

The terraced slopes, that lie between these upper and lower cliffs, offer some remarkable examples of the effects of atmospheric denudation on the rocks composing them.

From the escarpments on the hillsides, and from the faces of the cliffs, huge masses of partly-detached rock stand out at varying angles from the parent bed; and so unstable do many of them appear to be, that it seems as though but a touch is wanting to cause them to break away, and to precipitate themselves into the valleys beneath.

Examples of this kind are very common all round the coasts; but the cliffs on the northern side of St. Paul's Bay, and those along the southern coasts of both islands afford some of the best examples.

Strewn along the sides of the escapments in a state of wild confusion, lie rock masses of every conceivable size and shape, all of which have at some previous time formed a part of the cliffs that now rise some hundreds of feet above them.

The denuding agents of the atmosphere have contributed much towards this scene of destruction. Of these, frost, no doubt, played an important part during that period when the greater part of Europe was enveloped in a "mer de glace," and when arctic conditions of climate prevailed where temperate and even semitropical conditions now exist. (1)

But it is to wind and rain that the greatest amount of destruction seems to have been due. Their insidious attacks upon the sand and marl, that underlie the Upper Coralline Limestone, have wasted away these beds, and the upper deposits being thus undermined, have broken away in masses and have strewn the slopes with their debris.

At Fom-ir-Rieh, Ghain-Toffiha and Karraba there are several examples of areas consisting of many acres, that have broken off and have sunk to lower levels in consequence of the eroding action that the underground springs have had upon their unstable foundations.

The south and south-western shores of Malta appear to have been more subject to these landslips than any other part of the two islands, a fact that is attributable to the south-westerly dip of the strata between Carmola and Fom-ir-rieh. The rocks in these localities have, therefore, a tendency to slide along their dip-planes, and hence, when their foundations are removed, even in part, fractures of considerable extent occur.

How constant is the occurrence of these downthrows, is strikingly demonstrated by the Phoenician cart-tracks, that are found in various localities along the southern shores.

Many of these, after traversing the islands for some distance inland, trend towards the coast, and there break off at the very edge of the cliffs. The folk-lore of the people contains many curious fables relating to them, (1) but all of the accounts that are given agree in referring their origin to a time when the islands constituted a portion of the neighbouring continents.

That they are of very ancient origin, and that they serve to indicate some extensive changes in the configuration of the islands, there seems to be no doubt; but there does not appear to be any foundation for the statement that, at the time of their formation, the islands extended much beyond their present limits.

The ruts that terminate so abruptly at the cliffs-edge, probably, once formed a portion of a roadway that skirted the top of the Upper Coralline Limestone cliffs, and these, after being subjected to those processes of erosion to which reference has just been made, broke away from the main mass of the formation, and thus obliterated all traces of the former roadway that had existed along their summits.

The northern shores of both islands are much more indented than are those on the south. The succession of bays extending from Mars-el-Forn in Gozo, to Marsa Scala in Malta, and the elevations that lie between the bays, attest to the severe lateral pressure to which certain portions of the beds have been subjected.

Whether this pressure has been due to a shrinkage of the earth's crust consequent on the secular cooling of the globe, or to changes in the position of the land masses in the vicinity, that have been brought about by volcanic or other agencies, we are not in a position to determine. The results, however, show that the general tendency of the pressure has been to elevated and depress the strata, to a greater or lesser degree, throughout the whole length of the islands.

At Fom-ir-rieh, Karraba, St. Pauls Bay, the island of Comino, and Dueira these synclinal curves are especially marked, while in many other localities the strata have given way under the strain, and fissures and faults have been formed in consequence.

The effect of many of the fractures has been to change the relative position of the strata to the extent of several hundreds of feet.

(1) Jones (Prof. Rupt.) "On the Geology of Gibraltar." Geo. Soc. Journ vol. XXXIV. 1878. Geikie "Prehistoric Europe."

(1) Cooke J. H. "Sketches in, and about Malta" Valletta 1891.

An examination of the geological map, which accompanies this paper, will show, that all of the faults trend in the same direction.

The Great Fault, which extends from Maddalena on the north to some distance beyond Fomir-Rieh on the south, the fault that caused the separation of Comino from Malta, the dual faults at St. Pauls Bay and Melleha, and most of the minor fractures at Marsa Scala, Tignè and Mars-el-Forn, will be found to lie in a N. E. and S. W. direction.

The pressure that gave rise to these, seems therefore, to have passed along the major axis of the islands, that is, in a N. W. and S. E. direction; and it was exerted at right angles to these faults and in a line with the synclinal foldings.

To this rule there are two notable exceptions. The first is the Malak fault, and the other is the Miggiar Scini and the Dueira faults, both of which lie in a direction that is almost at right angles to the Great Fault.

(To be continued.)

SCIENCE NOTES.

A project is now on foot for the establishment of a marine station at Sebastopol, which is to be erected on the lines of the Zoological station at Naples, though on a smaller scale.

The greatest depth found by Captain, Spratt, R.N. in the Western Mediterranean basin was between Sicily, Sardinia and Africa, where the line showed about 10,000 feet, (a little over two miles).

Recent measurements in the Eastern basin by Commander Magnaghi of the Italian Navy have yielded as a maximum 13,556 feet, (nearly $2\frac{3}{4}$ miles), between the islands of Malta and Candia.

Cav. G. Gollcher of Malta has recently acquired a magnificent specimen of *Tridacna gigas* from the Indian seas. It measures 2 feet 3 inches, by 1 feet 8 inches, and weighs 152 lbs.

A large quantity of fossil mammalian remains belonging to a new fauna has recently been obtained from a tertiary deposit in Samos—an island in the Turkish Archipelago, lying immediately opposite the town of Ephesus, and to the south-south-west of Smyrna.

Their discovery has been principally due to the labours of Dr. Forsyth-Major, who spent upwards of two years in the exploration of the Pliocene fauna of Samos, during which period he obtained two very important collections, one of which is now in the Geneva Museum, and the other in the British Museum.

Neither of them has yet been thoroughly examined. Among the specimens are a number of forms specifically identical with the mammals from the equivalent deposits of Pikermi in Attica, Baltavar in Hungary, and Maragha in Persia; and also several new types, of which a large ruminant *Samotherium* is the most remarkable.

These remains are of much interest inasmuch as they afford evidences of a much wider distribution of forms in bygone ages.

In the course of the excavations at Pompeii the bodies of a man and a woman were exhumed from a deposit of volcanic ash, which was situate just within the Stabian Gate.

Imbedded in the formation were also found the impressions of the branches, foliage, and fruit of a tree *Laura nobilis*, the berries of which ripen only towards the end of the Autumn.

The discovery has an important bearing on the question of the time of the year at which the eruption took place, since it tends to show that it was in November, and not in August, as it has hitherto been supposed to have been.

At a recent meeting of the Academy of the Lincei Prof. G. Capellini drew the attention of the members to certain fossil remains that had been discovered in the "Argile scagliose" of Gombola in Modanese, and which had originally been referred to as being the remains of a crocodilian.

He entered somewhat at length into the distinguishing characteristics of the specimen, and concluded by showing that they were the fragments of a trunk of *Ichthosaurus camplodon,* which had been washed from out of the inferior cretaceous strata of the district by the action of running water.

The powder magazine explosion that lately occured at Porta Portese has been made the subject of a series of interesting observations by Prof. Tacchini, the results of which have just been published in the proceedings of the Lincei.

The instruments in the meteorological observatory at Rome were particularly affected, and gave rise to some extraordinary phenomena, the most marked of which was the action of the air pressure on the barometer, which caused a sudden fall of the mercury 11½ millimetres below the normal curve.

The sound of the explosion was heard at Ischia, Pasaro and Forli, places that are situated upwards of 156 miles distant from Rome.

The earth-tremors, that followed the shock, powerfully affected the seismical instruments of the districts around, and gave rise to the impression that an earthquake had occured.

The undulations were felt some time before the sound of the expolsion was heard; and Prof. Tacchini proceeds to demonstrate that the earth movements were transmitted with a velocity, that was double of that of that of the sound-waves.

Correspondence.

Rome, June 12th. 1891.

Sir,

Will you permit me to direct the attention of your readers to the importance of making full and accurate observations of all earth-quake shocks that may, in future, affect the areas in which they dwell. The Mediterranean district is especially suited for the making of a series of seismological observations both on account of the constancy of the recurrence of earth-tremors, and of the limited areas that are usually affected.

A complete seismic record for a definite earthquake area would be of the greatest scientific value, and such accounts, and observations, if forwarded to the "Mediterranean Naturalist," would serve as valuable sourse of information for future workers.

Yours truly
F. Baker.

(We commend the above letter to notice of our readers. We shall be glad to accord the space for any authenticated accounts of earthquakes in the Mediterranean area. Ed. M. N.)

Exchange Column.

Notices are inserted in this column free of charge. We request that all exchanges may be signed with name (or initials) and full address at the end.

Wanted dredgings containing foraminiferous materials from any part of the Mediterranean, papers on the foraminifera, or good micro-slides. A. Earland, 3 Eton Grove, Dacre Park, Lee S. E.

Wanted:—"Le formazioni Terzarie nella Provincia di Reggio (Calabria)," memoria del Prof. G. Seguenza 1877. "Contribuzione alla geologia della provincia di Messina."

Editor of "Mediterranean Naturalist" 48, Str. Mercanti, Valletta, Malta.

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CONTENTS.

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We shall be much obliged to those readers who will send us the names and addresses of the Libraries and Museums at which the "Mediterranean Naturalist" is not yet taken.

Assistance of this kind will not only be the means of increasing our circulation, but it will also enable us the sooner to arrive at the time when we shall be in a position to illustrate the pages of each issue, and we trust, ultimately increase their number.

To Correspondents.

All communications intended for insertion should be written on one side of the paper only; and should reach the Editor on or before the 12th of the month. Whenever an answer is required through the post, a stamped and directed envelope should be enclosed.

Secretaries of Societies are invited to forward us reports of their proceedings; and Curators of Museums will confer a favour by informing us of any new and important additions that may be made to their collections.

Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

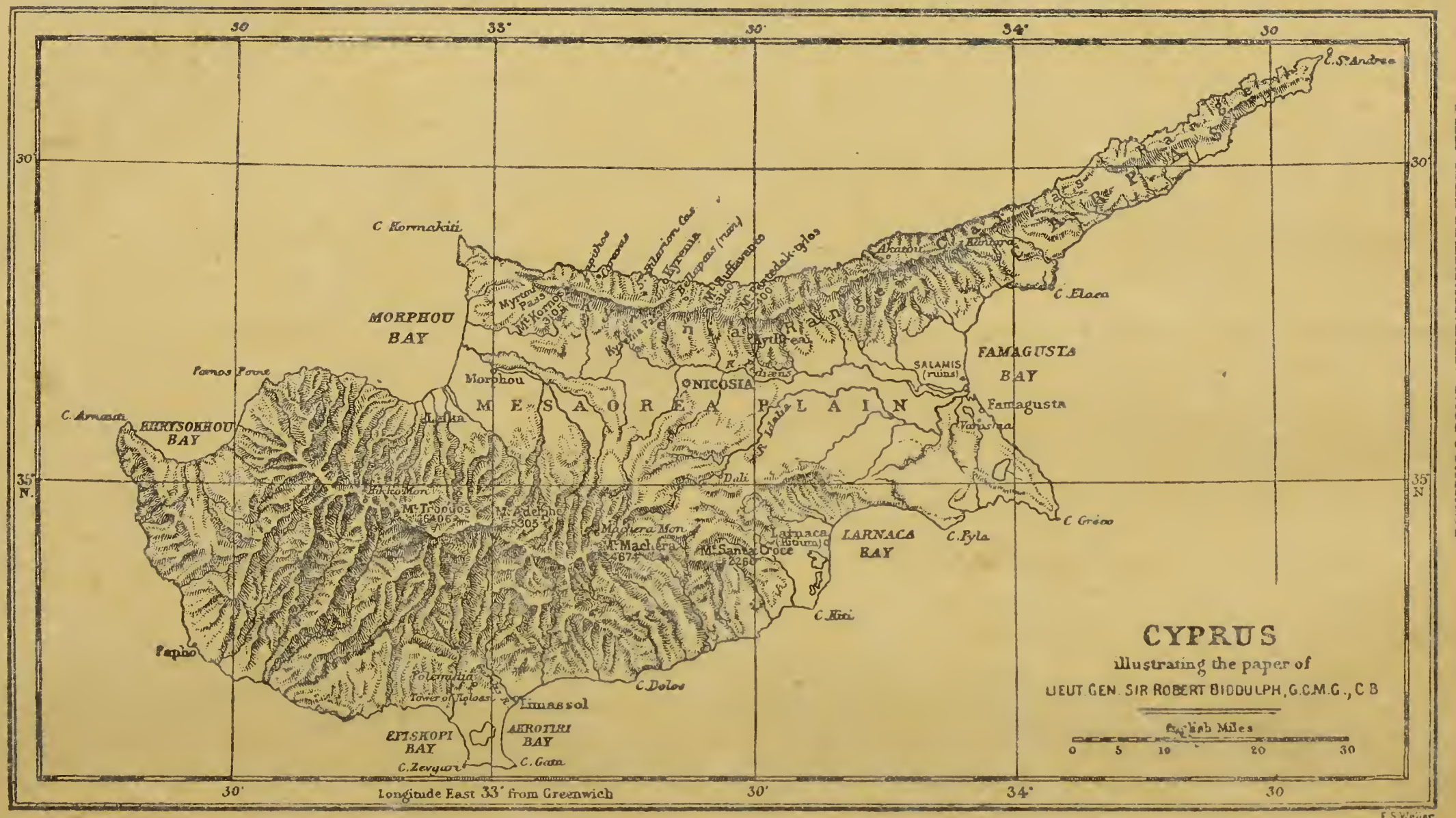
CYPRUS,

by Lieut.-General Sir R. Biddulph, G.C.M.G., C.B., late H. M. High Commissioner, Cyprus.

The island of Cyprus is the third largest in the Mediterranean, being inferior in size only to Sicily and Sardinia. Its area is 3584 square miles. Its principal features are two mountain ranges, running pretty well parallel to each other from east to west. The northernmost of these two ranges extends almost the whole length of the island from Cape Kormakiti on the north-west to Cape St. Andrea at the end of the horn-like promontory which stretches for 40 miles from the north-east of the island. This promontory is called the Carpas, and the low mountain chain running through it is called the Carpas range. The westernmost and higher portion of the northern range is called the Kyrenia range, and rises to an altitude of 3340 feet. This range is of a remarkably picturesque outline, in some parts extremely rugged. It is mostly a single ridge without any remarkable spurs, and its summit is about two miles from the northern coast. It can be crossed in many places, but there are three well-defined passes over it, viz. the Akatou Pass, which separates the Kyrenia and Carpas ranges; the Kyrenia Pass, which is due south of the town of Kyrenia, and forms the approach to it from Nicosia; and the Myrtou Pass, further west. The chief mountain peaks of this range are Kornos, 3105 feet; Buffavento, 3140; and Pentedaktylos, 2400. The last named is a remarkably shaped rock in the centre of the Kyrenian range, owing its name to its shape, the word Pentedaktylos signifying in Greek "five-fingered." Beneath this rock there rushes out southward from the mountain side, at an altitude of 870 feet, a torrent of water, which never ceases to flow summer or winter, and which, descending into the great plain in the centre of the island, carries its fertilising streams to the

lands of several villages, its course marked by mills, gardens, and trees, until its water is exhausted by various irrigating channels. The principal village watered by this stream is called in Greek Kythrea, and in Turkish Deyrmenlik (the place of mills). It is situated about 10 miles to the north-east of Nicosia.

A similar stream of water gushes from the northern side, about 12 miles west of the Kyrenia Pass, above the village of Lapithos, which, with the adjoining village of Caravas, are probably the most prosperous villages in the whole island. Smaller streams descend on either side of the range at various places—their waters are used for irrigation in the valleys.



The southern range of mountains is of a much more extensive nature than the northern range, which I have just been describing. The eastern-most point of this range is the mountain of Santa Croce, so called from the church of the Holy Cross which stands on its summit. This mountain, which is 2260 feet in height, is of a peculiar shape, and from its isolated position it forms a prominent landmark, not only for vessels approaching the port of Larnaca, but also for those entering Famagusta. Beginning then from this point the southern range rapidly rises to considerable altitudes, finally culminating in Mount Troodos, the highest point in Cyprus, 6406 feet above the sea-level. The other chief peaks in the southern range are, Adelphe, 5305 feet, and Machera, 4674 feet. But it is not only in altitude that the Troodos range is distinguished; numerous spurs run down to the north and south, and as we proceed further west these radiate out to greater distances, so that half way between Troodos and the sea, the mountain range is not less than 20 miles wide. Here there are very considerable forest, many miles in extent, rarely visited save by wandering flocks and by wood-cutters, and affording shelter to the moufflon, or wild sheep of Europe, some 200 or 300 of which still roam over these hills.

On the map it will be seen that numerous rivers descend from both sides of the southern range. These are mostly dry in summer, but after rain their waters descend with violence, filling up the river-beds in the plains, carrying away trees and cultivated patches, and often rushing in a turbid stream into the bays of Famagusta and Morphou.

Between the two mountain ranges which I have thus briefly described there lies a great plain called the Mesaorea, which is the most fertile part of Cyprus, growing large crops of wheat, barley, and cotton. It was evidently once the bottom of the sea, for in many parts are large beds of marine shells—gigantic oysters and others—all clustered in masses. A noticeable feature of this plain is the number of flat-topped plateaux of various sizes, where the rock seems to have resisted the action of the water. The tops of these plateaux are clothed with short herbage, affording a scanty provision for flocks, and are usually from 100 to 200 eet above the plain.

The rivers which descend from the hills carry down large quantities of alluvial soil, and this forms in the eastern part of the Mesaorea a rich deposit, something similar to the Delta of the Nile.

The two rivers which mainly contribute to this plain are the Pediæus and the Idalia, the former taking its rise from the northern slopes of Mount Machera and the latter from the eastern slopes of the same mountain.

The Pediæus flows nothward to Nicosia, and encircling that city, continues its course eastward through the Mesaorea, receiving the drainage of the northern range during its course, and falls into the sea near the ruins of the ancient city of Salamis. The Idalia, passing to the south of Nicosia through the classic valley of Dali, also flows eastward, and falls into the sea at Salamis, about half a mile from the mouth of the Pediæus. The beds of these rivers have, however, become so choked up with alluvial deposit towards the end of their course, that their waters overflow the plain and mingle together, so that their separate mouths can with difficulty be distinguished.

The only other considerable river rises on the northern slopes of Mount Adelphe, and after flowing to the north for about 20 miles, turns to the west, and passing the populous village of Morphou, flows into the Bay of Morphou.

The normal condition of these rivers is to be without water, but whenever there is a heavy rainfall in the mountains, the river "comes down," as it is called, and runs for one, two, or more days. During the winter months, from December to February, this frequently happens, and I have known the river Pediæus to be running for six weeks together, but this is rare.

It occasionally happens that the water descends with great suddenness and violence, causing disastrous floods. In December 1880, a storm of rain of the greatest violence burst over the valley of the Garilis, a small river which flows into the sea at Limassol. Six inches of rain were registered in three hours at the military cantonment at Polemidia, 3½ miles from Limassol. The water overflowed the narrow channel and flooded the town of Limassol, washing down many houses, destroying much property, and causing the death of several persons. A similar calamity is reported to have occurred at Nicosia about twenty-five years

ago. The river Pediæus, bursting its banks at a point just outside the western gate of the city, forced open that gate, which had been closed, and rushing through the town to the Famagusta Gate on the east side, the waters closed that gate, and, finding no egress, flooded all the lowlying central parts of the city, causing great damage and loss of life. The inhabitants of the Mesaorea are never more pleased than when the rivers come down abundantly, but from the want of proper storage and direction, much of the water runs waste into the sea, and much land is rendered uncultivable from being flooded. Since the British occupation an ancient canal has been repaired which carries off some of the surplus waters of the Pediæus, and irrigates a considerable tract of country but the question of water storage in Cyprus in one for which there is much scope.

Considerable supplies of water for irrigation purposes are obtained by sinking wells. A long chain of wells are sunk at distances of five or six yards apart, and being connected by underground galleries, a channel is thus formed which conveys the water to a reservoir constructed at the foot of the last well, and it is thence raised to the surface by the waterwheel; or in some cases the level of the ground admits of the channel being brought out on the surface. In this way the town of Nicosia is supplied with excellent water, which is brought in two aqueducts from a distance of some miles. Larnaca and Famagusta and other towns have similar aqueducts.

Closely connected with the water supply is the forest question.

Cyprus was anciently clothed with forests. In Old Testament times much shipbuilding took place. In Balaam's prophecy we read that "ships shall come from the coast of Chittim", and it was with Cyprus timber that Alexander the Great built the fleets which he launched on the Tigris and Euphrates. At the present time the forests are confined to the mountain ranges, and threaten to disappear altogether.

At the time of the Egyptian occupation of Cyprus, vast quantities of timber were cut down and carried to Egypt. In this way the whole country round Larnaca was completely denuded of trees. Previous to that time, the low hills to the west of Larnaca were covered with forest. Now but a few dwarfed and scattered specimens remain. It is not till we approach the mountain of Troodos that we find anything like a real forest. Here, on the spot where the summer encampment of the troops is fixed, there are some magnificent specimens of the *Pinos Laricio*, which clothe the mountains from an altitude of 4500 feet upwards. The Aleppo pine furnishes, however, nine-tenths of the forests. It attains very fine dimensions in Cyprus, and flourishes on all sorts of mineral soils to an altitude of 4500 to 5000 feet. Trees of 10 feet in circumference are frequently met with. The forests continue westward from Troodos, though much encroached upon, and cruelly misused by reckless felling, and tapping for resin, until we pass the monastery of Kikko. Between this point and the sea, to the extremity of the watershed, there are real forests, and those of a very considerable extent, covering an area of over 200 square miles. These owe their immunity partly to their large extent; but more especially because the spurs and valleys leading to them are of so difficult a nature that the transport of timber is not easily effected. It is here that the few remaining cedars of Cyprus are to be found; occupying a space of seven or eight square miles, at a mean altitude of 4500 feet. They resembled the Atlas cedar; none of the trees exceed 80 years of age, an insignificant age for a species that reaches 2000 years.

The crest of the northern range is also fringed with trees, and there are other patches of forest land containing brushwood and a few trees. On the whole, the forest lands of Cyprus occupy an area of 400 square miles. At the time of the British occupation, the ravages of the woodcutter were to be seen in full operation, and it cannot be doubted that it was only a question of time when the last remaining forests of Cyprus should entirely disappear.

The destruction of the forests dates, however, from modern times. For many centuries a vigorous felling went on, which gave to the wood of Cyprus an unique reputation in the Eastern world. I have already alluded to the fleets built by Alexander the Great from Cyprus timber; the Venetians also took immense quantities for their commerce and marine. But this would only affect the old and fine trees, because young trees are of no use for

shipbuilding; hence the forests would always be renewed from the young trees. Great damage must, however, have been done by the mines which were so extensively worked by the Phœnicians and the Romans, as trees of all sorts and sizes would be used for fuel. With the cessation of the mining, the forests must have again recovered themselves; and the true causes of the modern destruction of the forests are stated to be three in number, viz. fitful cultivation, fire, and the grazing of goats.

It is beyond the province of this paper to enter into detail on these points. They have been most ably dealt with by a French gentleman who was for three years the principal forest officer of Cyprus. But it may be interesting just to draw attention to the manner in which Cyprus is overrun by goats, which are the greatest enemies to forests in every country where they exist.

Taking five Mediterranean countries where goats abound, we find that there are:—

In Italy	14	goats per sq. miles,	63	per 1000 inhabitants.
,, Sicily	16	,,	74	,,
,, Portugal	27	,,	210	,,
,, Sardinia	25	,,	374	,,
,, Cyprus	64	,,	1430	,,

Cyprus, in fact, contains more goats in proportion to its area and population than any country in the world.

(To be continued.)

The Culture of Figs.

W. F. Massey.

A large portion of North Carolina is well adapted to the culture of the fig, and in every part of the State a supply for home use can be had by taking a little trouble in growing the trees in proper shape for protecting them in winter. The writer for many years succeeded in growing, fine crops of of figs in a cold and elevated locality in northern Maryland, where the mercury dropped below Zero nearly every winter. The method used will be explained further on. All over the low country of eastern and southern North Carolina the fig thrives luxuriantly, and needs little, if any, winter protection, except in unusually severe winters. In all this section the culture of improved varieties gmiht be made profitable.

With a view to distribute among the cultivators of the States, the North Carolina Experiment Station has procured, through the United States Department of Agriculture at Washington, cuttings of the best varieties from fig-growing countries of southern Europe and Asia Minor. These include all the famous sorts used for drying and exportation.

In tropical countries the fig is an ever green tree, growing and bearing fruit almost perpetually, but in countries where sharp frosts occur in winter it assumes the character of a deciduous tree.

When the frosts are not too severe, or when the trees are protected from them, the rudimentary figs, borne on the young branches in late autumn, instead of falling off, as most immature fruits would do, seem to rest dormant, and in the Spring renew their growth and ripen off into the first crop, which always gives larger and finer fruit than the late summer and autumn crops. If we give the trees protection in winter, these immature figs can be carried through quite severe winters, but with the careless culture which the fig receives in North Carolina they are usually lost. The fig may be grown from seed, cuttings, or layers. The seed of the freshly imported dried figs will usually grow readily, and will generally reproduce a variety with certainty from cuttings of well ripened one year old wood, or layers must be used.

In propagating from cuttings, young shoots growing on the sides of older stems, and not the rank and pithy shoots from the base, are best. These should be cut off in autumn after the leaves fall, with a "heel" of the older wood. Set the cuttings at once in dry sandy soil nearly their entire length, and then make a ridge of soil over them thick enough to keep out frost. When Spring opens, carefully scrape away this cover of soil so as to expose the tops of the cuttings, and they well soon break into growth and make fine plants by autumn. Layers are made by binding down a shoot of last year's growth, cutting a slit in the side of the shoot nearly half way through, so that the end of the shoot can be turned up and tied to a stake, and the incision buried in the soil. This should be done in Spring, and by Autumn the layer can be separated from the plant with a good supply of its own. Where there is a greenhouse

convenient, and command of heat can be had, the plants can be rapidly increased in winter from single eyes of the mature wood. These are potted when rooted, and planted out in nursery rows in Spring, making large bushes by Autumn.

People who have not studied the structure of plants commonly suppose that figs have no bloom. This is far from being the case, for the flowers are wonderfully numerous. The fruit of the fig, popularly so called, is simply the floral receptacle, and the whole interior is covered with minute flowers. After these flowers have set seed the receptacle continues to grow and ripen, forming, with the seed carpels within, the edible fruit.

The best shape to grow fig trees in frosty climates is in the form of a spreading bush or shrub, branched from the ground. Little pruning is needed. The rank, sappy shoots from the ground should be kept down after enough limb are formed to make the head. The best figs are grown on the short-jointed shoots produced on the older wood, and the pruning should be mainly the shortening back of the branches lightly, after the crop has been gathered, to encourage the production of these shoots the following year.

Where the winter temperature seldom falls below 18°. or 20°. above Zero, figs will need no special protection, but will be all the better for being planted in a situation sheltered from cold winds. In cold climates figs can be easily protected in winter if branched from the ground. This is done by gathering the branches together in four bundles, after the leaves have fallen, and bending them flat to the ground in the outline of a cross. Fasten the branches down with forked pegs, and them cover with earth. Let the earth cover be fully six inches thick and in very severe climates cover the mound, when winter has fully set in, with straw or forest leaves, to prevent too severe freezing. The earth cover will be sufficient anywhere in North Carolina; anywhere east and south of Raleigh no special protection will be needed. In the upland region about Raleigh they will be safer if bent to the ground and a few pine bushes laid over them. There is no good reason why, in the coast region at least, the culture of the fig for drying might not be profitably pursued. At any rate, figs preserved in glass or tin will always meet a ready sale, and in the immediate vicinity of the larger towns the sale of fresh figs could be made profitable to a limited extent. With the extension of canning and preserving factories in various parts of the State, the culture of the fig can be extended indefinitely. In the careless method of culture now practiced here, or rather the no culture at all, the fig bush has to fight for existence with the weeds and wild growth in fence corners, and no pains being taken to protect it in winter, the figs formed in the fall of the year are usually destroyed by the winter and spring frosts. These fall set figs, if saved over winter, make the finest fruit of the season, and ripen in early summer, while almost the only figs now known here are the late summer and autumn crop, which are much inferior in size and quality to the early crop. On the immediate coast in the vicinity of salt water the fig flourishes and grows to a large size, but anywhere in the interior the crop will be better by keeping them pruned to bushes of six or seven feet high, and giving them whatever protection the situation requires. Our plantation of figs at the North Carolina Experiment Station is not yet developed to such an extent as will enable us to distributed long cuttings at present. We shall use all our wood the present winter in propagating under glass from single eyes, and hope in the spring of 1891 to have a moderate supply of young plants for distribution in the eastern and southern sections. Those applying for plants will be required to file a written agreement to give them proper care, to keep the varieties distinct, and to report to the director of the station in regard to the quality and productiveness and the comparative hardiness of the trees. Applications complying with these terms should he sent in during February and March, and will be filed as long as the supply of plants lasts.

N. C. Ag. Expt. Bulletin.

Dr. John Murray on the Origin and Character of the Sahara.

At the last annual meeting of the Scottish Meteorological Society Dr. John Murray read a paper on the meteorological conditions of desert regions, with special reference to the Sahara, the

northern border of which he had recently visited. He pointed out that the arid regions of the world were distributed in two bands, north and south of the equator. They were all inland drainage areas, or areas where the streams had no connection with the sea. They were also regions where evaporation was in excess, for if the latter were in excess the water would rise till it could flow into the sea, as in the case of the great lake district of North America, and the area would no longer be one of inland drainage. The largest of the deserts, the Sahara, was about three and a half million square miles in area, and the area of all the deserts of the world to-gether was about 11,500,000 square miles. That was to say, over one fifth of the land of the world had no outlet for drainage to the sea, and in all that area evaporation was greater than precipitation.

This area corresponded very closely with the regions of the world where the rainfall was less than 10 inches annually. In no place in the world could there be got such enormous ranges of temperature as in the deserts. In the Sahara the temperature sometimes fell from 100 degrees during the day to the freezing point during the night. That arose from the great dryness of the atmosphere, and from the radiation that took place from the burning soil after the sun had set. These inland drainage areas corresponded very much in their barometric phenomena. In all desert regions during summer all the winds blew in to them. In winter the reverse took place—the winds flowed out of them, and that held good both for the northern and the southern hemispheres. This let to the low rainfall, for the great majority of these regions were more or less bounded by high hills. The winds came into the deserts over these hills, and the vapour was precipitated from the atmosphere by the hills, with the results that when the winds reached the interior regions there was nothing left to be deposited. If there were not hills all round any desert area, as in the case of Northern Asia, the winds passed from a colder to a warmer climate, and as they got to warmer regions they were able to contain more vapour, and none was precipitated. Dr. Murray then proceeded to give an account of his own views and impressions as to the Sahara. During the *Challenger* expedition he and his companions had found in the bed of the Atlantic for a long distance west of the African coast opposite the Sahara, and in the bed of the Indian Ocean to the south of Australia, small grains of red quartz sand, and they had found scarcely a trace of such in the sea-bed in any other part of the world. He suspected this quartz sand had been blown out from the Sahara in the one case, and from the Australian desert in the other. On his journey southward through Algeria, he found the country as far as Tougourt converted into a garden by means of artesian wells. At Tougourt the real sandy part of the desert began, and he made excursions into it, with that town as his headquarters. He exhibited to the meeting a specimen of the sand, of a light yellowish-brown colour, and exceedingly fine in the grains. There were, he said, a good many clay particles in it, and the quartz particles, which were also numerous, were identical with those they had got in the bottom of the Atlantic. There was no doubt that the winds from the desert carried the sand a long way out to sea. He had also examined the region geologically, and the formation of the rocks was entirely that of fresh water, and of quaternary date. The great majority of geographers and geologists had expressed the belief that the whole of the Sahara was an old sea-bed, but he was of opinion that it had never as a whole been covered by the sea since Cretaceous or Devonian times; and no part of it, he believed, had been covered by the ocean since Tertiary times. The whole question about the discovery of shells seemed to rest upon one common species being found very rarely in one region of the desert. He thought that, owing to recent researches, the opinion as to the Sahara, being an old sea bottom was very likely to disappear from our text-books. He considered that the features of the region had been produced by atmospheric conditions. The sand was the product of the disintegration of the rocks in situ. The existing rock was not far below the surface, and by digging down to it, the hard sandy particles were found embedded in the stone. The sun shone on the rocks and they expanded. The sudden cooling at night broke them up, the wind carried away the smaller particles, and so continually were the rocks being disintegrated by means of changes other than water, although water perhaps had in

times past played a greater rôle there than it did now. There was a range of hills in the desert, 7000 feet high, and for three months of the year their summits were covered with snow. Descending the hills were old river-courses, some of great length. Much of the region, he considered, had once been a large freshwater lake. Speaking of the commercial aspect of the Sahara, he said it was difficult to go there without becoming enthusiastic about it. But there seemed to be no limit to the amount of water that was to be got by sinking artesian wells. The cultivation of palms was extending to an enormous extent, and the French expected to carry on their railway to Tougourt in the next few years. R. G. S. Journ.

NOTES AND NEWS.

Mr. R. Lydekker lately read a paper before the Zoological Society of London on a Cervine jaw which was obtained from a pleistocene deposit in Algeria, and which appears to indicate the former existence in that country of a large deer allied to Cervus cashmirianus. For this new form Mr. Lydekker has proposed the name *Cervus Algericus.*

The honey of the Malta bees has long been noted both for its purity, and for its delicious flavour. The latter is largely due to the extensive crops of sulla (clover) that are annually raised throughout the islands, from which the bees derive the largest proportion of their material. It is estimated that to collect one pound of honey from clover, 62,000 heads of clover must be deprived of nectar, and, 3,750,000 visits from the bees must be made.

In our next number the first of a series of articles on "The formation of Mountain Chains" will appear, written by Mr. T. Mellard-Reade C.E., F.G.S., F,R,I,B,A., the eminent physicist whose book on the subject has attracted so much attention in the scientific world, and whose theory has had such an influence on current geological thought.

Since Livingstone's memorable journey across the "Dark Continent," Africa has been crossed no less than twelve times. The Portuguese traveller Silva Porto followed Livingstone, Cameron crossed it in 1873, Stanley in 1874, Major Serpa Pinto in 1877, the Italian Mattucci in 1880, Cap. Wissman in 1881, Ivens and Capello the Portuguese explorers in 1884, and in 1885 by the Swedish Commissioner Lieutenant Gleerup. Since then Stanley has recrossed it, and Captain Frivier of the French army as also performed the same task.

Among the prizes that are to be awarded by the French Academy in 1892 is the Jecker prize of 10,000 fr. for discoveries in organic chemistry; the Bréan prize of 100,000 fr. (£4,000) for the discovery of a cure, or preventive of Asiatic cholera; the Argo gold medal for any discovery that may have been of real service to science; the Leconte prize of 50,000 fr. for any invention or work on natural history, physics, mathematics, chemistry, or physiology; and the Montyon prize for the best contrivance whereby the ordinary occupations of life may be carried out with the minimum of danger.

In a communication that M. Mares lately made to the French Meteorological Society it was shown that the weather in Algeria had been as remarkable as had that which had characterized the last winter, and spring in Europe.

The author stated that in many localities the excessive rain-fall had prevented the sowing of seeds, and in the mountainous districts, where the sowing had taken place early, the seed had been swept away by the torrents. About the third week in January a heavy fall of snow lay on the Mitidja and the Sahel for two whole days. The writer states that for the last thirty five years, although he had sometimes seen snow fall, it did not lie an instant on the ground.

Observations on the Geology of the Maltese Islands.

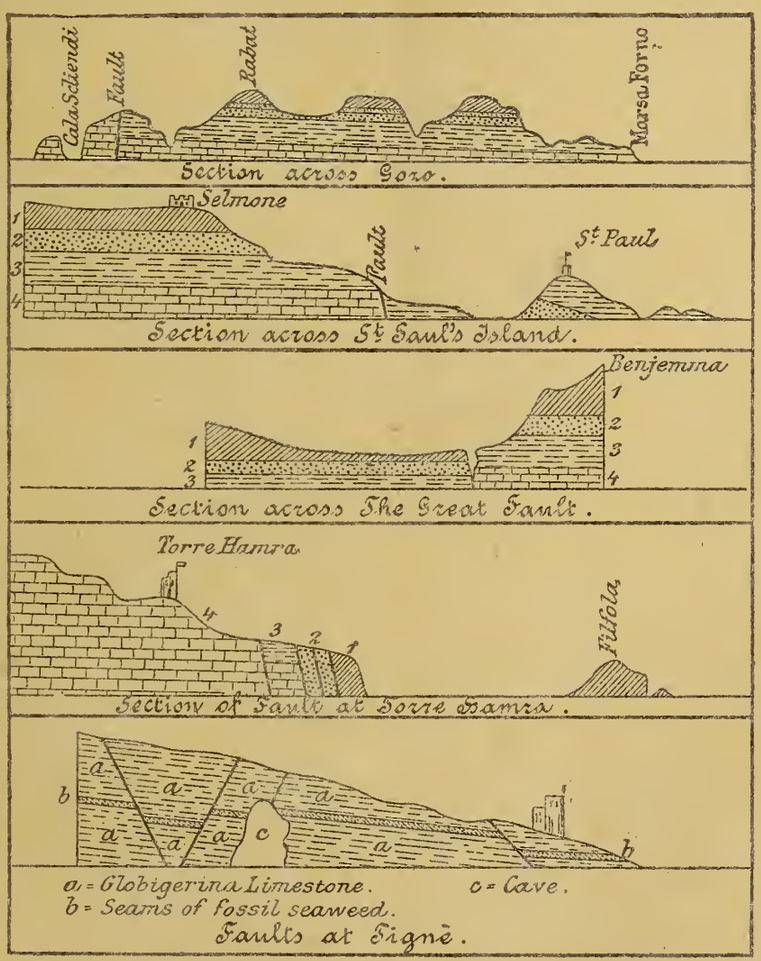
BY JOHN H. COOKE.

(continued)

These forces of compression seem to have been the original causes that gave a general undulatory outline to certain portions of the strata, and thus by determining the position of the islands' principal watersheds, they prepared the way for the formation of the hills and valleys.

But though they were the origin, they were not the agents of their formation.

The ruggedness of surface contour, and the wholesale denudation that now characterizes the scenery of Gozo, and north-western Malta, owe their origin to other and less ostentatious forces, which, if more dilatory in their methods were yet none the less effective in their operations.



A few walks along the coasts, and the hill-sides will bring vividly before the mind of the observer the active manner in which the three henchmen of Nature—Fire, Air, and Water—have been at work in disintegrating the rock surfaces and moulding the islands' contour. The faces of the cliffs and faults, the sides of the hills and valleys, alike tell the same tale and point to the silent though effective manner in which Nature brings her forces to bear, in order to attain her end. The barren and denuded cliffs of Uied-el-Asel, and Dueira, attest to the irresistible power of the waves, that once laved their water-worn and pholas-bored sides, while the fantastic shapes into which the honey-combed and fretted rock-surfaces are even now being wrought, indicate that, though far beyond the reach of the waves, they are still subjected to the attacks of other foes equally powerful and untiring.

The soft Globigerina Limestone and the softer sand and marl beds, are particularly susceptible to this constant wear and tear of the atmosphere; and the consequence is, that wherever these beds are found to predominate, there the soil of the country is more abundant, and the scenery is more diversified.

The long-continued dry weather of the summer months, followed by the moisture ladened winds from Africa, have played an important part in this work of erosion.

Fissures, that at first appeared as mere cracks in the strata, have been gradually enlarged by the disintegration of their sides, and the rains of winter, entering the channels that have been thus prepared, have formed torrents, the waters of which have greatly facilitated the work of destruction.

In this manner the anticlinals and fissures have been so extended and enlarged as to have lost their original character, and to have assumed the characteristics of gorges and valleys.

The contour of the surfaces of both islands has been thus moulded and so rapidly does the work of erosion even now proceed, that, it is only by the watchful industry of the husbandman in banking up the sides of the valleys with debris, and protecting the accumulated soil with stone walls of considerable thickness, that the superficial waste is retarded sufficiently to allow him to till and grow in the soil such of the neces-

saries of life as will suffice for the support of himself and of his family.

Were it not for this intervention, the surface strata of the Maltese beds would not long resist the perpetual wear and tear; but here it is that the beneficent wisdom of the Creator is shown.

The forces of Nature are so distributed, that they often render their own efforts abortive; and by acting in antagonism, the one neutralizes the effects of the other.

The subœrial forces act upon the rock-surfaces and in course of time they convert the superficial areas into soil. The rains of winter then wash this away, and thus new surfaces are presented to be acted upon in precisely the same manner as the former had been. Here the husbandman steps in, and by means of artificial contrivances, he diverts the drainage, tills and protects the newly-formed soil, and sows the seed which is to bring forth the future crop.

The rootlets disseminate themselves throughout the mass, and by firmly binding it together, they form a covering for the underlying rock which effectually resists any further denudation.

It is by the instrumentality of processes such as these that the islands have been made to assume their present aspect; and were it not for them, many of the most fertile valleys of the islands would be rendered quite barren, while others would lose such a large proportion of the soil that is annually being formed by the waste of the surrounding rocks, as to cause them to become much less productive than they now are.

The Binjemma plateau, which is situated to the south-west of Malta, is intersected by numerous valleys and gorges all of which furnish innumerable instances of the conservative, and destructive effects of Nature's handiwork.

Of these Boschetto, Emtahlep, and St. Pauls valley will perhaps afford the geologist some of the best opportunities for the study of this phase of the geological history of the islands.

Boschetto lies about two miles to the south of Città Vecchia, and is much resorted to on account of its varied and interesting scenery.

"Traced in a map, the landscape lies,
In cultured beauty stretching wide."

while Emtahlep, with its rippling springs, its orchards, and its verdure covered slopes is situated about three miles to the west of the city. Water is found there in great abundance, but, owing to the numerous faultings in the strata, much of it finds its way into the fissures, and from thence into the sea.

In Gozo, there are a large number of similar valleys, chief among which are Ramla and Marsa-el Forn; but though they offer special attractions to the botanist and the entomologist, yet they cannot be recommended to the geologist, as the outcrops of the beds are invariably masked with taluses, that have resulted from the degradation of the superincumbent strata, and therefore the work of examination is rendered both tedious and uncertain.

These fertile valleys always occur whereever the upper beds (1) crop out. In the Lower Coralline Limestone districts, however, sterile, rocky gorges take their place, and they are generally found either to abut on the coast, or else to occupy the low-lying lands in the vicinity of the sea.

The most typical of this class are Dueira in Gozo, and Uied-el-Asel in Malta, the water worn sides of both of which, attest to the presence of the waters of the sea at a comparatively recent date, when probably they formed harbours, similar to those existing on the eastern coast at the present time. The abrupt termination of the Gargur, and the Musta gorges are strikingly analagous to the mouths of the Grand and of the Marsamuscetto harbours.

A depression of a few feet would again submerge a considerable portion of the northern part of Malta, and would be the means of refilling many of the ancient creeks and harbours of the islands.

Thus, such a depression would, by filling the valleys of Tal Puales and St. Pauls cause a considerable extension of Melleha Bay, and St. Paul's bay.

(1) Beds I, II, III & IV. Med. Nat. Vol. I No. 2 p.

It would submerge a large part of the Nasciar plain, and would add to the length of St. George's Creek, St. Julians bay, Marsa Scala, and Marsa Scirocco Bay.

All of these bear evident traces of the former presence of the sea. Nor are they the only evidences that testify to the oscillations to which the islands have been subjected. A never ending contest has been, and still is going on between the land and the waters around them, in which each has alternately gained the mastery; but in the latest phase, the land has, bit by bit, gradually asserted itself and has won back the territories of which it has been despoiled.

The protracted nature of the struggle is plainly shown by the craggy and cavernous condition of the sea cliffs, that abound along the southern coasts of the islands.

At Magira, Ras-el-Kaus, Ahmar, and Ghain Toffiha, flat, raised, marginal ledges skirt the shore, situated at varying heights above the sea level, and on some of these, as at Toffiha, are insulated, table-shaped stacks of upper limestone, which, being sufficiently hard to enable them to successfully withstand the constant attacks, that wore down the softer material around them, now stand alone, bearing unequivocal testimony to the power of the elements that had shaped them, and to the duration of the ages that must have elapsed ere they were reared to their present positions.

The Faults:—

The relationship that exists between the physical character, and the internal structure of the Maltese Islands is well illustrated in the valleys and hills to which reference has just been made.

We have seen that the strata does not preserve that uniform horizontality that it had when deposited, but that in many localities it takes a slightly undulatory form, a change of position that was probably caused by the lateral pressure which was exerted when the faults of the islands were formed.

The elevations and valleys that lie to the north of the Great Fault and in the vicinity of Ghain Toffiha, Redum Majesa, Fom-ir-rieh, and Melleha afford some of the best illustrations of the effects of these compressive forces.

The strata of several hills in these areas show evidences of dipping inwards, that is, they lie in slight synclinal curves.

It is to this condition of the strata that the combes and valleys in the district appear to owe their existence. The Northern coast, too, abounds with similar examples, especially the strata that lies on either side of Melleha Bay, St. Paul's Bay, and the Straits of Frioul.

South of the Malta Grand Fault these synclinal curves are not so well marked, though here and there along the southern cliffs of Malta examples are to be met with. Thus Benghisa Gap owes its origin to the synclinal bending of the rocks in its course, and the cliffs under Maddalena chapel exhibit further similar evidences.

Between the surface contour of northern and southern Malta there is however a marked contrast, and compared with the north, the strata of the southern area are practically horizontal save for a slight north-easterly dip. This contrast is due primarily to the oscillations of level to which the islands have been subjected, and which have caused the depression of the whole of the area that lies between the northern side of the Grand Fault of Malta and the southern side of that of Gozo.

The Grand Fault or principal fault of Malta extends from the Maddalena Bay on the west coast to Fom-ir-rieh on the east coast.

At Fom-ir-rieh the beds of the Upper Coralline Limestone, and the Marl on the northern side of the fault are opposed on the south by vertical cliffs of Lower Limestone, that attain a height of nearly 350 feet. The faces of both sides of the fault are covered abundantly with well defined examples of "slickensides", the depth of the scorings of which, sufficiently attest to the enormous grinding processes to which the rocks were subjected when the depression took place. At Naxaro, the cliffs of the fault are but 150 feet in height, but from thence they increase until Maddalena is reached where they end abruptly at a height of about 350 feet above the sea level.

Standing on the summit of the escarpment in the vicinity of Naxaro and taking either Città Vecchia or Chemmuna as points for observation, the inclination of the beds to the south may be traced in an east-south-easterly direction until

they disappear beneath the water of the sea all along the coast. The surface of this part of the island takes the form of an undulating plain in which the Globigerina Limestone and the Lower Coralline Limestone alternately appear. The latter crops out in the vicinity of the Lunatic Asylum, at Musta, on the coast of St. Julians and Pembroke, the coast to the east of Ricasoli, the cliffs at Marsa Scala, and the lower portions of the cliffs along the south coast of Malta; but in no case does the surface area of the outcrops exceed a few hundred square yards in extent, and therefore the area of exposed Lower Limestone bears but a small ratio to that of the Globigerina deposits. On the northern side, the depression of the district has submerged the coast outcrops of these beds, and the superior deposits have therefore been brought to the sea-level.

It is an interesting fact to note that most of the principal faults of Malta and Gozo trend in the same direction, that is they run almost due east and west, and therefore are nearly parallel to one another.

If the Grand Fault and the other principal fractures be produced in an easterly direction it will be found that they will all meet at nearly the same point beneath the waters of the sea in about 55°. lat.

It would appear, therefore, as though these fractures owed their origin to one common cause, and that the pressure which gave rise to them must have passed along the major axis of the islands.

Faults at St. Paul's Bay :—

The strata on either side of St. Paul's Bay have been much crushed and broken by these compressive forces. The valley is bounded on either side by a compound fracture, both of which extend right across the island, and in a direction that is parallel to the Great Fault and to one another.

The fault of the northern side of the valley consists of two parallel fractures, which coalesce beneath Selmone and passes on through Selmone Island to the eastern shore.

The lines of disturbance may be traced right across the island, as they are clearly marked by a range of Upper Coralline Limestone cliffs, the sides of which have been worn into caves and fissures of all sizes by the chemical action of the atmosphere.

The throw of the fault varies from 30° to 60°, and averages about 130 feet.

On the southern side, the line of displacement is even more pronounced, and like that on the northern side it consists of two parallel fractures, both of which abut on the western coast in the vicinity of Ghain-Toffiha, and, after traversing the island they coalesce at the head of St. Paul's Bay, and finally disappear beneath the waters of the Mediterranean. The western extremity of this fault affords many remarkable examples of the bending and crushing effect that these displacements have had upon the strata. The area that is situated between these two sets of faults dips in a south-easterly direction, and is depressed to such an extent that the upper beds that form the bottom of the valley have been brought into juxtaposition with the Globigerina Limestone along the southern line of disturbance. The average dip throughout the valley is about 20°, but at Selmone Island it is much greater. The strata of these islets have been considerably tilted, in some instances lying at an angle of 60° with the horizon. Besides these two fractures there are numerous others of a minor character, but generally they are but superficial rents, that have probably been caused by the overstrained contortions of the strata.

The Melleha Faults:—

Like St. Paul's Bay, the valley and bay of Melleha are bounded on either side by faults that are parallel to one another, and that are slightly inclined in a south-easterly direction towards the Grand Fault. The area between them has been depressed, and a valley has been formed the eastern extremity of which now lies beneath the waters of the Mediterranean. The fault on the southern side of the bay extends from the eastern to the western shores of the island. Its throw varies considerably throughout its length, being the greatest towards its extremities; thus, below the village of Melleha its downthrow is about 100 feet, while at Melleha Point and Redum Majesa it is 130 feet.

On the northern side of the bay the fracture does not appear to be so extensive; but this is owing to its partial submergence beneath the waters of the bay. Like its complement on the southern side it extends from shore to shore, and in the same direction.

The throw of the fault is due south, and its angle varies from 30° to 55°.

The average length of the throw is 120 feet. The immediate effect of these two faults has been to cause a further depression in an already depressed area. The top beds of the Upper Coralline Limestone have thus been brought to the sea-level, and are now so rapidly being encroached upon by the sea, that in the course of a comparatively short period of time, the peninsula of the Marfa, that forms the northern extremity of Malta, will be converted into an island similar to Comino.

The Malak Fault:—

The displacements, that we have just been considering, traverse the island in a direction that is parallel to that of its shorter axis. To these the fault at Malak is a notable exception. This fracture trends in a direction that is at right angles to the Grand Fault, and parallel to the major axis of the island. It extends from Torre Hamra, near Crendi, to the south western side of the little bay of St. Giorgio, a distance of about two and a half miles.

The effect of the Malak downthrow has been to depress, and submerge the whole of the deposits that were formerly situated in this part of the island, with the exception of the narrow strip of the upper beds that now skirts the cliffs at the sea level and the islet of Filfola, which is situated at a distance of about three miles from the shore.

The surface of this remmant is in many places, covered with detrital material that has been derived from the degradation of the surrounding upper areas, and which has formed a breccia consisting of large quantities of mammalian remains and rolled pebbles, the whole being bound together by means of calcareous infiltrations.

Below Torre Hamra another faulting has occurred in the depressed area, the total downthrow of the two displacements amounting to about 400 feet. The Upper Coralline Limestone has been much contorted and broken in its downward descent, and in some of the little bays that here fringe the shore, it offers some peculiar examples of curves and foldings. The breccia that caps this downthrow is the "Elephant bed" of Dr. Adams. It is literally full of the bones and molars of the elephants that had formerly made Malta their home.

It was in this locality, too, that the now famous Malak Caverns were discovered, in which Dr. Adam's worked so successfully when studying the ancient mammalian fauna of the islands.

Minor faults:—

The dislocations of the strata, and the consequent slight alterations in their relative positions to one another. that occur in St. Julian's Bay, the Marsamuscetto harbour, and other localities are usually so small as to be hardly worthy of being classed with the great faults. But they make up in number what is wanting in magnitude, and we shall therefore here note a few of the more important of them.

To the south of Dingli a fault traverses the strata from the coast to Boschetto, but the down throw is but a few feet. At the mouth of the Emtahleb valley there is another, that is of somewhat greater magnitude. It runs in a direction that is parallel to the Malak Fault, and therefore at right angles to the Grand Fault.

It has been the cause of depressing a considerable area to a depth of about 100 feet.

On the south-eastern side of St. Julian's bay there are several depressions where the Globigerina has been let down to distances varying from one to ten feet; while at Tignè, Ricasoli, Marsa Scala, Marsa Sirocco, Mars-el-Forn, the number of these minor dislocations is legion. Some idea of nature and extent of these may be obtained from Fig (*).

Near the village of Crendi there is a circular fault that has caused the downthrow of an area, of about 70 square yards, which is known as Macluba.

It is similar in many respects to the circular depression at Dueira, but it is not so extensive. A more detailed account of it will be given when discussing the caves of the islands.

The Gozo Faults:—

The system of the faultings in Gozo is more complex than is that of Malta; but there is a great similarity in the accompanying phenomena which

* *See Med: Nat: No. 4, Sept. 1891.*

tends to prove that the Gozo and Malta faults were either contemporaneous and therefore dependent upon the same causes, or that the one system was but an after consequence of the other, owing to the line of weakness in the islands structure that the first series of fractures had caused.

The Grand Fault of Gozo consists of two great branches, the one extending from Dueira to Chambray, and lying in a direction that is parallel to the Malak fault, and the other extending from Ras il Kala to Chambray, and lying in a direction that is parallel to that of the Grand Fault of Malta.

The result of the latter displacement has been to depress the area to the south of its line and to bring all of the superior deposits on a level with the middle beds of the Globigerina Limestone. This fault is the complement of the Malta Grand Fault. They were probably formed contemporaneously and so caused the depression of the whole of the area lying between them.

At Ras-il-Kala where this fault abuts on the coast, another downthrow has taken place the line of displacment of which trends in a direction that is more south west than is that of the Grand Fault; it extends as far as Chambray, while another fracture runs parallel to it from Madonna della Kala to the same point.

The area at the north-eastern extremity of Gozo is much broken up by a series of complex fractures, that have given rise to triangular down-throws and up-throws.

The southern portion of the main fracture is more simple in its nature.

It has resulted in the depression of the whole of the area that lies to the south of it, and which extends from Miggiar Scini to Cala tal Sclendi.

It diverges at Monsciar and passes on to Dueira, where, in conjunction with another fault on the northern side of Dueira bay it has caused the depression now known as the Dueira Valley. Just below Gebel ta Ben Georgio the throw of the fault is about 150 feet, but towards St. Paolo the throw does not average more that 80 feet.

Beside these, there are numerous other minor displacements along the southern coast of the island, but none of them are of any considerable magnitude. Between Ras-el-Trebona and Ras-el-Newhela three or four of these fractures occur, all of which are at right angles to the main line of disturbance, and parallel to the Malta Grand fault. The throws, however, are insignificant, as in no instance do they exceed 10 ft; and are often very much less.

On the northern side of the Dueira bay a circular fracture has occurred, which has been the cause of the sinking in of the superior deposits to a depth of at least 300 feet. Within the depression the Globigerina Limestone, the Marl and small portions of the Upper Coralline Limestone are found *in situ*, the surface of the topmost layer of which is situated at a depth of 50 feet below the surface of the cliffs of Lower Limestone that lie around it. Denudation is rapidly progressing as the sea has eaten its way through the Lower Limestone, and is now degrading the remnant of these upper beds, so that in the course of a comparatively short space of time, nought but the escarpment of the Lower Limestone will be left to bear evidence to the downthrow that had taken place there.

(To be continued.)

Discovery of fossil remains at Arpino.

Prof. G. B. Cacciamali lately made an interesting discovery of fossil mammalian remains during the construction of the branch railway to Arce-Lora, in the Arpino district. The excavations were carried through a formation the upper part of which was composed of alternate layers of tufi and conglomerate, while the lowest consists of a bluish mud of pliocene origin.

Large quantities of teeth and bones were found embedded in the conglomerate, a number of which were extracted and submitted to Professor Meli of Rome for identification. Among them were found a lower and an upper jaw with molars *in situ* of a deer (Cervus elephas fossilis). Detacted molars of deer, and the jaws and molars of a pig. (Sus scropha fossilis).

In the recent beds the remains that were discovered were even more curious and interesting, consisting of the inferior molars of *Bos primigenius*, and the canine teeth of *Hippotamus major*.

Insect plagues around the Mediterranean.

Insect plagues seem especially active this year, though agriculturists had hoped that the hard winter would have killed most of their enemies. The Bavarian forests are being perfectly devastated by the caterpillar of the Nun-Moth, which eats right through the wood of strong trees, especially of firs and pines. The various officials give the people lectures on the moth and the means of its destruction, while even the school children are employed to kill the pest, and special prayers are offered in church for the arrest of the plague. Hitherto the large sums of money spent on various methods of killing the moth, have produced little result. So, too, with the locusts in Algeria, which defy all efforts to restrict their advance. The vines are the worst sufferers and while the masculine population of the various districts burn the eggs, cover the various insects with lime and so forth, the women and children march about with old trumpets, gongs, drums, and tin pans making a hideous noise to frighten the locusts away.

In the central Sahara, the locusts have cleared the pasture lands so completely that the Tomareg Arabs have been driven out of their haunts towards Tunis for lack of food. In Egypt the plague is more under control, but great alarm is felt nevertheless. *Graphic.*

NEWS OF THE MONTH

On the night of June 30th. various parts of the province of Verona were visited by a recurrence of strong earthquakes.

At Tregnago, where the recent shocks were especially severe, and at Cogolo, several walls, and the wooden supports of a number of houses collapsed.

The people at both places rushed from their houses in alarm, and sought safety in the open fields. No loss of life is reported.

A new work on "The South Italian Volcanoes," edited by Dr. Johnston-Lavis is about to be published at Naples. It will contain an account of the excursion that was made under the auspices of the Geologists' Association of London in 1889; and also papers, descriptive of the different localities visited, written by Messrs Johnston-Lavis, Platania, Sambon, Zezi, and Madame Antonia Lavis. A bibliography of the volcanic districts will be appended.

Prof. Marion has founded a marine station at Endoume near Marseilles, for the purpose of making a special study of the fishes of the Mediterranean; and Dr. R. Dubois, Professor of Physiology in the Faculty of Science at Toulon has opened a marine station at Tamaris, near Toulon.

The Atmospheric effects, that the clear, translucent air of the Mediterranean often gives rise to, were particularly exemplified on several occasions during last month. During the clear weather that prevailed in the middle of July the phenomenon of irregular diffraction was especially shown by the raising of the line of sight to such an extent, that objects at great distances, that are at other times completely concealed from view, were apparently raised so much above their true position as to be clearly discernable from the shores of Malta and Gozo. The cliffs of the coast-line, and the undulatory contour of the mountains of Sicily were to be seen distinctly with the naked eye on the 11th. and 12th. inst; while the outlines of Etna stood boldly out against the clear, azure sky, and though

situated at a distance of upwards of 100 miles away, yet the form of the mountain was perfectly recognisable.

In the course of some experiments that have lately been carried out on certain plantations in the vicinity of Algiers, Sigr. Trabut discovered that locusts are liable to a disease that gives rise to a high rate of mortality among them.

A fungus parasite has been found growing on the bodies of these insects, which Trabut has named *Botrytis acridiorium*, before whose attacks they rapidly succumb.

Trabut is now engaged on further experiments for the purpose of ascertaining how far it will be possible to cultivate this parasite, in order that it may be utilised against the noxious insects whose ravages have lately caused such irremediable damage to the crops of the country.

Two manganese mines have been opened near Ordou in Trebizond. The one, Bos-Tepeh, is situated about a half an hour from town, and the other, Alajadam, some two hours to the east near the sea. Both seem to be surface mines, yielding for the time being about 64 per cent of manganese. The final concession has not yet been obtained, though Mr. Koerner, the engineer in charge, is allowed the right of shipping the ore to the extent of 1000 tons.

The right of felling trees in the 665,0000 square miles of the Kerassond forests, and in the 497,000 square miles of the Tireboli forests, has been ceded by Government to private speculators.

They are in hopes of realising large profits by the sale of timber, firewood &c., in and out of the country. The wood obtainable in those parts consists mainly of oak, pine, chestnut, fir, birch, beech, and cornel.

Exchange Column.

Notices are inserted in this column free of charge. We request that all exchanges may be signed with name (or initials) and full address at the end.

Offered lantern slides, unmounted, of the geological, and picturesque features of the Maltese Islands in exchange for lantern slides, mounted or unmounted of other geological phenomena. M. C. care of the Editor of the "Mediterranean Naturalist" 48 Strada Mercanti, Valletta, Malta.

Wanted for cash or exchange, Hincke's "History of the British Zoophytes", Johnson's "British Zoophytes", and Pennington's "Natural History of British Zoophytes". The Editor of the "Mediterranean Naturalist" 48 Strada Mercanti, Valletta, Malta.

Wanted dredgings containing foraminiferous materials from any part of the Mediterranean, papers on the foraminifera, or good micro-slides. A. Earland, 3 Eton Grove, Dacre Park, Lee S. E.

Wanted:—"Le formazioni Terzarie nella Provincia di Reggio (Calabria)," memoria del Prof. G. Seguenza 1877. "Contribuzione alla geologia della provincia di Messina."

Editor of "Mediterranean Naturalist" 48, Str. Mercanti, Valletta, Malta.

Editor J. H. Cooke B,Sc., F.G.S. Malta.

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CONTENTS.

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Subscriptions are now due.

Special Notice to Readers.

We shall be much obliged to those readers who will send us the names and addresses of the Libraries and Museums at which the "Mediterranean Naturalist" is not yet taken.

Assistance of this kind will not only be the means of increasing our circulation, but it will also enable us the sooner to arrive at the time when we shall be in a position to illustrate the pages of each issue, and we trust, ultimately increase their number.

To Correspondents.

All communications intended for insertion should be written on one side of the paper only; and should reach the Editor on or before the 12th of the month. Whenever an answer is required through the post, a stamped and directed envelope should be enclosed.

Secretaries of Societies are invited to forward us reports of their proceedings; and Curators of Museums will confer a favour by informing us of any new and important additions that may be made to their collections.

Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

Theories of Mountain Formation.

By T. Mellard Reade, C.E.,F.G.S.,F.R.I.B.A.

Part I. *

THE origin of the surface features of the earth has always been a subject of interest to observing and thinking men. Some of these features—such as, for instance, deltas—were from a very early age recognised as the work of agents still in force. The delta of the Nile, it was obvious, even to Greek philosophers unaccustomed to geological reasoning, had been laid down by the river itself. Rounded pebbles found in the rocks, it was correctly inferred, had been so shaped by moving water.

Such geological inferences as these have been probably, to a greater or less extent, common to all historic time.

It is also a peculiarity of the human mind that it must frame hypotheses to account for what it sees. The first formed, of course, are little better than shrewd guesses at truth; but it would be difficult to point to any existing theory which had not been to some extent guessed in the hoary past; and thus limited we may correctly say "there is nothing new under the sun."

To those who understand the processes of scientific discovery it is hardly necessary to point out that there is no such thing as absolute truth. Explanations of phenomena must take their shape and color from the state of science at the time, and, while no explanation is absolutely true, on the other hand few are absolutely false. As a rule, there is some small kernel of truth to be found in every attempt made by a reasonable man to explain to himself what he sees.

It is only within the last hundred years that geology has been systematically studied, so that if theories relating to the formation of the surface features of the earth have been crude and undeve-

* *These articles appeared in their original form in "Research".*
They have since been revised and added to by the author for the columns of the Med: Nat:

loped it is only what might have been predicated of them. A true theory must take account of all the phenomena found in connection with the effect it professes to explain. How, then, could this have been done of the crust of the earth before the nature of that crust had been approximately ascertained?

The origin of Mountain Ranges is a subject which hitherto has not received much systematic study. It is true that several eminent men have made valuable suggestions as to the forces which they think have been left in a very crude and unfinished state, and the proofs offered not being of a quantitative nature have scarcely been satisfactory. Indeed the facts of mountain geology without which no theory of any value could be formulated have become known of late years.

After having devoted many years to the study of the dynamics of Mountain formation my views were set forth fully and scientifically in a work published in the latter part of 1886 * but it was thought that a general view of the leading features of my theory might prove of general interest, as well as forming an introduction to the larger work.

Doubtless the primitive idea of the origin, not only of mountains, but of valleys, is that still held by people who have not thought much on such subjects, that they are due to "convulsions of nature", and earthquakes and volcanoes are pointed to as remnants of forces which acted with greater intensity in former ages. It is, therefore, interesting to find, in the travels of Sir John Mandeville, the following rather different attempt to account for the origin of hills and valleys. "And thus have mountains and hills been, and valleys, which arose only from Noah's flood, that washed the soft and tender ground, and fell down into valleys, and the hard earth and rock remain mountains where the soft and tender earth was worn away by the water and fell and become valleys."

We have only to substitute "subærial denudation" for Noah's flood and we have to a large extent the modern notion of the origin of these surface features as first systematically developed by Hutton.

Avicenna, an Arabian physician of the tenth century, writing on the cause of mountains, says "some are formed by essential, others by accidental causes." A violent earthquake, by which land is elevated and becomes a mountain is an illustration of the "essential." Excavation by water, by which cavities are produced and adjoining lands made to stand out and form eminences, is an illustration of the "accidental." Confined air seeking vent, by which plains have been upheaved into hills, is one of tne geological ideas Ovid credits Pythagoras with.

Probably most people's elementary ideas now go very little further than the foregoing. I confess that I studied geology myself for many years without having anything but the haziest notions on the subject. That grand work, Lyell's *Principles*, to which geology and geologists are so much indebted, is unsatisfactory on the subject of the origin of mountain ranges, inasmuch as it is more of the destructive than constructive order. Lyell plainly sees and shows how the theory of Elie de Beaumont, the only systematic theory then in existence, was in conflict with geological facts; but in my opinion Lyell fails, or, rather, does not try, to formulate any theory which may take its place.

It appears that the idea underlying de Beaumont's theory had occurred long before to Sir Isaac Newton. He suggested that the cooling of the interior of the earth would produce compression in the outer crust through gravitation, as the crust in following the shrinking centre would be compelled to adapt inself to a less extensive area; hence ridges or mountains would be thrown up. This in the crude form is the idea underlying what is called the "contraction theory" of mountain formation, which has hitherto occupied perhaps the first place as an explanation of the origin of mountains. It is true that many geologists have been inclined to place expansion by heat as a cause more in conformity with geological fact, and it was long since pointed out by Babbage, Scrope and Herschel that the laying down of sediment would of itself cause a rise of temperature in the crust, in the same way that a top coat or blanket does in the human body.

The theory was, however, never by them sufficiently developed to take the place of the earlier "contraction theory," which has held its own as apparently invoking the only known cause suffi-

* "*Origin of Mountain Ranges, Considered Experimentally, Structurally, Dynamically, and in Relation to their Geological History.*"

ciently potent to account for such grand features as mountain ranges, though Captain Hutton, of Christchurch, New Zealand, pushed the reasoning further in a very suggestive paper published some years back in the *Geological Magazine*.

The contraction theory, as stated by its exponents, was doubtless sufficient—and, indeed, as Lyell pointed out, much more than sufficient—to account for the upheaval of all the known ranges considered as so many cubic miles of rock.

Notwithstanding that so many mathematicians and physicists had worked at the problem, the underlying idea was that the *whole* of the solid crust of the earth—a very vague term—must be in compression by the cooling of the nucleus, the favourite illustration being taken from the apple in which the core consisting of the fruit contracts by drying, while the rind remains of the same dimensions, or nearly so and is consequently thrown into wrinkles. Who does not remember the familiar "wrinkled hand" photographed in Nasmyth and Carpenter's work on the Moon, as another illustration, though the appositeness of the analogy is, to say the least, doubtful. That most supporters of the theory without further inquiry accepted the position that all the rigid crust of the earth must be in compression is sufficiently evidenced by the remarks in Prestwich's *Geology*, vol. II., p. 540 (1887), where even the possibility of a shell 800 miles thick being in compression is discussed but rejected. Prestwich, along with some other geologists, thinks that the hard crust of the earth rests upon a semi-fluid zone, and that the whole of the crust, whatever thickness it may be, is in compression. Although this is not always expressly stated by the upholders of the contraction theory, it, so far as my acquaintance with the subject extends, inferentially forms the basis of their reasoning. At any rate, whether considered partially fluid or solid throughout, they assume the earth to be divided into a contracting nucleus and an uncontracting crust, and we are left to put any quantitative value we like upon either. This may be seen by a reference to Geikie's *Text-Book of Geology*, and Green's *Physical Geology*, both justly considered standard geological works.

In my *Origin of Mountain Ranges*, published towards the end of 1886, I pointed out that the crust of the earth, whatever thickness we assign to it, must, on the assumption of secular cooling, excepting at the surface, be itself contracting. If we assume the earth to be solid throughout, and to be divided into a series of thin shells, each under shell, commencing with the one immediately below the surface, will circumferentially contract more than the one above or enclosing it until the zone of maximum contraction is reached, when the underlying shells will contract less than those overlying them, till a depth is attained at which there is practically no contraction. As the earth is cooling from the outside, and the mean increase of heat downwards is about 1° in 60 feet—and even less, as estimated by some authorities—a simple calculation will show that the cooling of the body of the earth is now of only a superficial character, not, practically speaking, penetrating above 200 miles. From this it will be seen that the radial contraction of the earth is limited to the depth to which it has cooled from the exterior, and therefore the apple illustration, where the core contracts *throughout*, is quite misleading.

Vague general statements instead of quantitative determinations are responsible for much inconclusive geological reasoning.

It may be almost taken as an axiom that physical without quantitative reasoning is, more often than not, quite misleading. But, to return from this digression, it is readily seen that the radial contraction of the earth must be of limited quantity, and, this being so at a certain calculable depth, the mean rate of circumferential contraction must be equal to the mean rate of radial contraction.

The shell at this depth, whether the nucleus be fluid or solid, will be neither in compression nor tension, while all above will be in compression and all below in tension. Speaking exactly, this neutral zone may be looked upon as a shell infinitesimally thin, and it has since been appropriately named by Rev. O. Fisher the "level of no strain." The whole of this reasoning with an illustrative diagram, may be seen in Chapter XI. of my *Origin of Mountain Ranges*, and it is there shown that this zone or level-of-no-strain in our globe, cannot be situated many miles below the surface.

Since my chapter was written, the subject has been investigated by Davison, Darwin, and Fisher. The first of these mathematicians contributed a

paper to the Royal Society, in which he estimates that the level of no strain is now, after the lapse of about 174 million years, about five miles deep, while Darwin places it at two miles deep in 100 million years since consolidation, and the Rev. O. Fisher at less. My own calculations agree pretty closely with the two latter, but the depth will vary according to the assumed data of consolidation, co-efficient of expansion of rock, &c., upon which the estimate is based. The agreement of these independent investigators is, however, remarkable.

Theoretically, the depth of the level-of-no-strain varies as the time, and the amount of rock crushed may be represented by a cone the base of which is the difference in area between the surface of the globe before, and the surface after contraction having a height equal to the depth of the level-of-no-strain. It will thus be seen that the cubic quantity of rock crushed will be only one-third of what it would be with a crust the thickness of the depth of the level-of-no-strain and unaffected by cooling in its own substance. It follows from these various considerations that the compression of so thin a shell is inadequate to account for the upheaval of mountain ranges as we see them upon the earth, and that geological facts are eloquent against this explanation of what is colloquially called "mountain building."

The discovery of the existence of a neutral zone or level-of-no-strain in a cooling globe has revolutionised geological thought as is clearly stated in the able Smithsonian review of Geological Science for the years 1887 and 1888 by Professor Mc Gee.

An examination of most great ranges show that they have a central core of gneissic and granitic rocks forced up through the overlying sedimentaries, which are folded into loops between the intrusive tongues of gneiss.

The phenomena of mountain structure lead us to the conviction that the lateral pressure increases with the depth instead of diminishing, as it should do on the contraction hypothesis.

It is from these considerations, together with a wide range of geological inferences, that lead me to reject the contraction explanation of mountain formation, and to seek for another more in conformity with nature. In a future number I propose to give an outline of my own views as to the structure and origin of these great corrugations of our earth. *(To be continued.)*

Observations on the Geology of the Maltese Islands.

BY JOHN H. COOKE

(continued.)

The caves & fissures of the Islands:—

Like all freestone districts, the Maltese strata present unequivocal evidences of the destructive forces of the elements air and water. In the course of his peregrinations around the cliffs and through the gorges of the islands, the attention of the observer will be especially attracted to the great number of caverns that occur in their limited area. They are remarkable, however, for their number, rather than for their proportions, for few of them attain any considerable size. This is largely due to the nature of the strata in which they have been formed, as, owing to their comparative softness the caverns usually collapse when they reach a certain limit. But small as they are, most of them are invested either with a mythical or an historical importance. The ancient inhabitants of Malta, like those of the neighbouring countries, were ever ready to assign to the heroic all that was in the least incomprehensible to them.

The folk-lore of nations teems with examples of the manner in which natural phenomena have awakened the curiosity and fear of the untutored mind, and it has been, when labouring under the delusions that such feelings as these excite, that the extravagances and fables, that are often handed down to us as history, have had their origin.

Numa is said to have consulted Egeria in a cave, which is still shown at Rome; and the caves of Sicily have, from time immemorial, been credited as being the favourite haunt of a gigantic race of ghouls.

In Malta, the grotto dedicated to Calypso, at once recalls the fable of Homer; while the Har-Hasan cave conjures up vivid heroical scenes of the deeds of derring do that were formerly perpetrated on the high seas by the chieftan with whose name the cave is now associated.

The Malta caves may be classed under two heads; those that have been formed by the mechanical erosion of the sea, assisted by the chemical processes of the atmosphere: and those that owe their origin to the percolation of rainwater saturated with carbonic acid, through the fissures that have been formed in the island's strata.

Examples of the former occur all around the coast lines of the islands, but they may be studied to the best advantage whereever the Upper Coralline Limestone appears at the sea-level along the coast. The romantic scenery of the western coast of Comino owes its origin to these causes. There, the whole of the deposits that underly the Upper Coralline Limestone have been submerged, leaving this bed as the sole representative of the area that once united Malta and Gozo.

Unlike the northern and southern shores, those of the east and the west present to the Mediterranean waters a succession of precipitous cliffs and weather beaten headlands, that attain a height varying from 100 to 180 ft. Compared with the cliffs on the south coast of Malta, they may appear somewhat insignificant; but their want of altitude is fully compensated for, by the wildness of their contour, and the picturesque groupings of the detached masses that lie among their bases. All of the energies of the devastating forces of nature have been concentrated on the work of destruction, and have left behind indelible records of the terrible rigour of their attacks. Rock masses have been torn away, and hurled to incredible distances, thus forming a series of sunken reefs, and fantastically shaped islets, which, in tempestuous weather, are at once the refuge of the myriads of gulls and rock pigeons, that have there fashioned a home, and the dread of the fishermen, who gain a scanty livelihood, by toiling in the surrounding waters. The mural cliffs of many of these islets tower to a height, that is but little less than that of the cliffs of the formation of which they once formed a part; but, while possessing all the majesty of proportion of the parent bed, they have also a rugged beauty so entirely their own, that it constitutes a feature in the sea-scape, which by the contrast, tends to bring other not less remarkable features quite into a position of subordination.

It is to the north-east wind, that these disastrous effects among the cliffs and precipices of the islands are to be attributed. This wind blows, during the winter time, with unremitting fury for many days together; and one has but to watch the huge breakers, that are then raised, and hurled with resistless violence against the shores of the isles, to be able to form a good idea of the magnitude of their power, and of the amount of destruction that they are capable of effecting. The atmosphere takes no mean part in these operations; but its efforts are chiefly confined to the softening down of the angularities which the constant fractures in the strata, have given rise to. But extensive as is the amount of work for which it is responsible, its effects can in no way, be compared with those wrought by the action of the sea waves Even the least observant, in the course of a ramble around Comino's shores, cannot but be forcibly impressed with the truth of this assertion.

Whenever the waves have been unsuccessful in their attempts at destruction with one set of operations, they have fallen back upon their exhaustless resources, and have utilised another set. Where sheer force has failed, they have employed more insidious methods to attain their end; and thus, masses, whose bulk, and weight have enabled them to successfully withstand the tempests of centuries, have yet been compelled to yield to the silent working of those less ostentatious, though not less formidable enemies, which, with never tiring zeal, have perforated them through and through, thus forming caverns and archways of intricate forms and of majestic proportions. But nature, like a fitful child, that dashes to the ground the card-house, which it has taken so much time and patience to build up, does not long remain content with the work upon which she has spent her energies in the fashioning. She creates, but to destroy; and works as energetically in the work of destruction, as she does in the work of fabrication.

The mazy windings of the cliffs, crags, stacks, caverns, archways, and buttresses that abound along the coastlines of the islets afford indubitable proofs of her destructive effects; and after the monotonous aspect of the surface of the adjacent island of Comino, with the sterility of its scanty soil and the solitude of its deserted slopes, such

scenes of ruin and devastation as are here presented, give rise to reflections, that seldom fail to impress the observer with the might of the power of the elements and the comparative insignificance of that of man.

Cala Hein, a little bay situate between Comino and Cominotto, is of special interest to the lover of nature.

The scene, that is presented to the view from the lofty summits of the cliffs of Comino, offers some charming contrasts; but it is not to be compared with that which this little bay and its surroundings afford.

On a bright day, its waters present an endless succession of the most brilliant colours, which commences with a deep blue, and from thence passes through every conceivable gradation of green, orange, and white after attaining the last of which it again graduates onward in the distance, to that cerulean blue, that is so characteristic of Mediterranean waters.

Nor is the setting less effective than the picture. The rays of a tropical sun diffuse a silvery sheen, that hangs over the whole like a soft transparent drapery; while the countless reflections, from the wavelets that play in the path of every beam, scintillate and sparkle, with a lustre, such as even the Kooh-i-nor—though it might equal—could never excel.

The sombre looking entrances to the caverns, and the wildly fantastic shapes that many of them assume, form an appropriate contrast to the calm stilless and the rich colouring around, and by thus serving to heighten the effect of the scene they seldom fail to create an impression such as can never be recalled without conjuring up a host of agreeable reminiscences.

For the geologist, the sides of these caves are of unusual interest, as they literally teem with the remains of creatures that formerly lived and died in the waters in which the islands were built up. They form a sarcophagus of such antiquity that the most ancient of the Egyptian tombs is but of yesterday in comparison.

In the islets on the opposite side, other caves occur: some, squat and irregular in their outline; others all that is graceful and symetrical.

Caves, in whose wave-wasted sides broad platforms have been scooped out, and are now filled with cool, crystal waters, that might almost serve as baths:—

"Where-in sea-nymphs might lie
With languid limbs, in summer's sultry hours."*

And these wave-formed caves are typical of those that are, now in course of formation all around the southern coasts of both islands.

In the Lower Limestone they are, however, not quite so picturesque, though they appear to be much more solid and substantial. Here and there where the waves have enlarged a fissure or fault and have formed a small bay, the precise nature of the Lower Limestone cavern may be seen to advantage. They are generally found to lie in one of the softer veins of the rock, from which the incessant lashing of the sea, assisted by the chemical action of the air, has eroded the material of those portions, whose chemical composition and structure were the least suited to withstand the constant and insidious attacks directed against them. The material that has thus been worn from out the cliff face strews the beach as boulders and pebbles, the polished and fractured state of which serve as mute, though significant witnesses of the part that they too have occasionally played in the work of destruction.

The "Globigerina" cliffs around Sliema, and Tigne have been worn in a similar manner, but the caves found there are neither so large in size, nor so complicated in structure as are those that are found to occur in the superincumbent and the subjacent beds. The deposit is not well adapted for the formation of caverns, as it readily disintegrates and splits up. All around the shores of Ghar-id-dud, Marsa-Sirocco, and Mars-el-Forn numberless examples of the manner in which this has been done, are to be seen.

At Ghar-id-dud, especially, there are at least six well marked examples of caves whose sides and roofs have collapsed under the strain to which they have been subjected after the excavating agents have reached a certain limit.

(To be continued.)

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* *For a further description of the caves of this bay see. "Sketches in and about Malta" price 1s. Valletta 1891.*

CYPRUS,

by Lieut.-General Sir R. BIDDULPH, G.C.M.G., C.B.,
late H. M. High Commissioner, Cyprus.

The manner in which the destruction of forests is accomplished by goats, is described by Darwin and others with regard to the island of St. Helena. "The goats were introduced into the island in 1502, and increased there in a short time beyond all measure. But as they only destroyed the young trees and respected the old, their ravages were not at first perceived. In 1710 the forests were still very thick; but in 1724 the old trees having arrived at the term of their existence, and having nearly all fallen, and those that ought to have replaced them not having sprung up, the forests disappeared almost suddenly, and were replaced by thick grass. The climatic disturbance thus caused to the island was very great and mischievous. In 1731 all stray animals were destroyed; but too late, as is always the case." Darwin, writing in 1836, adds: "Sandy Bay is nowadays so arid that it was necessary for me to see an official record to believe that trees had ever grown there."

The French forest officer whom I have mentioned, M. Madon, made a very careful examination of the best-preserved parts of the forests, and showed the following results:—

(1) For every hundred trees which were standing, there were 72 that had been felled and were left lying on the ground to rot.

(2) For the same number of standing trees (100) there were only 25 seedlings.

The first shows the result of wasteful and reckless woodcutting. The second is the result of the indiscriminate pasturage of goats.

I have dwelt a little on this forest question because it has very sensibly affected the wealth and productiveness of the island. As the forests disappeared, so did the soil that covered the hills. That soil was washed down to the plains, choked the river-beds and formed malarious swamps, the hills became bare rocks incapable of growing a blade of grass, and the locust at once took possession of the barren ground, whilst the absence of trees deprived the earth of its annually fertilising agent, leaf-mould. There is now a stony desert at the south-east of the island between Famagusta and Larnaca, where tradition says there was formerly a large forest, and to the east of the Mesaorea, on the now dry and desolate plateau, there are many lime-kilns now in ruins, which could not have been supplied except by a vegetation that has now altogether disappeared.

I have alluded to the appearance of the locust as being connected with the disappearance of the forests, and so much has been said about the locusts of Cyprus that I must not wholly pass them by without mention. The Cyprus locust is a small species, indigenous to the island, and is not the great migratory locust which is so well known. The young locusts make their appearance early in March, like very small flies in appearance, but they grow rapidly, and in a few days begin to hop along in masses. They do not begin to fly for about six weeks, and it is during the crawling stage that their destruction is effected. After they begin to fly nothing further can be done.

The inventor of the system used for destroying them is Mr. Mattei, a gentleman of Italian extraction, whose family have been long settled in Cyprus. He had observed their habit of moving straight in masses, so that on arriving at any deep ditch or well, they fell in and were unable to extricate themselves. On one occasion he was watching a large swarm which approached the city of Nicosia; on reaching the walls they climbed up them, and where the top of the wall was broken they entered the town, but in some places there was a smooth band of plaster on the top of the wall. He observed that they could not walk on this smooth surface, but fell back into the ditch. At once the idea flashed into his mind of making an artificial wall with a slippery top to it to arrest their march. Filled with the idea he hurried home, and the first thing that met his sight was a table-cover of shiny American cloth. Dragging it off the table he began to cut it up into strips, in spite of the remonstrance of his wife, who thought he was out of his mind. These strips he sewed on to the top edge of lengths of canvas, and this originated the system which has continued with little change to the present time. Briefly the system was this: long screens of canvas about three feet high, with a band of oilcloth four inches wide running along the top edge of the screen, were stretched along the ground, supported by stakes driven into the

ground at intervals. These screens often extend for several miles, and are placed so as to cross the line of march of the locusts. At the foot of the screen, pits about five feet long, 2½ feet wide, and three feet deep, were dug, a wooden frame covered with zinc was put on the top of the pit so as to cover its edges. The locusts on arriving at the screen climb up it, but on reaching the top they find the strip of slippery wax-cloth, and fall down. After trying it over and over again, they turn the direction of their march and hop along at the foot of the screen, till they presently meet one of the pits and fall into it. They climb up the sides to get out again, but are met by the smooth zinc surface at the edge, and fall back into the pit; others come hopping in on top of them, and they are soon smothered by each other.

The system has been maintained by us in principle, but has been improved in detail. The wooden frames have been abandoned, and strips of zinc are used instead, which are laid on the ground, overlapping the edges of the pits. By this means they can be adapted to pits of any size, and a great saving is effected in the coast of transport, for when a swarm of locusts has been destroyed the screens and traps are taken up, packed on mules and donkeys, and carried off somewhere else. In places where the locusts are thick or where they tend to accumulate, such as the mouth of a small ravine, very large pits are dug, covering a surface of 80 to 100 square feet. The locusts come pouring into these like a waterfall, and making the same rushing kind of noise.

When once the locusts begin to fly the traps are useless. The period for the locust campaign only lasts, therefore, for about six weeks, and everything depends on an active prosecution of the campaign during that period. If large swarm escape the whole work has to be gone over again the next year.

It was this consideration that led me to see that it was necessary to centralise the management of the locust campaign under one head. When each commissioner managed it in his own district, swarms constantly escaped from one district to another, and it was impossible to alot beforehand the screens and traps according to the wants of each district. Much time was lost in sending material from one district to another. I therefore placed the whole under the Government engineer, and as public works were stopped for the time, all his organised labour was turned on to the work of locust destruction. The result was most successful. The number of locusts had been gradually increasing from 1879 to 1882. That year the conduct of the campaign was partially centralised, and the numbers of 1882 remained stationary. In 1883 the operations were thoroughly centralised under the Government engineer, and when the season opened in 1884 a large decrease was perceptible. The destruction was very complete that year, and thenceforward it was only necessary to have operations on a minor scale, so as to keep down any swarms that appeared. In 1885 I was able to report that the operations had practically come to a successful conclusion, and it has since been only necessary to prevent the few that annually appear, from increasing so as to make a fresh head again.

The greatest number which, it was calculated. were destroyed in one year was 195,000 millions in 1883, and the following year 56,000 millions. The estimated number of eggs laid by those that escaped in 1883 was 169,432 millions, and in 1887 it was 1216 millions, of which probably one-half would not come to maturity. The extraordinary fecundity of the locust is such that one pair of locusts left uninterruptedly to breed, would in ten years reach 2000 millions, even if one-half of the eggs failed to hatch out or were otherwise destroyed.

(To be continued.)

Rare occurrence of OPHRS APIFERA in Malta

Professor G. Gulia was the first to note the occurrence this orchid in Malta, and in his work on the orchids of Malta, which was published in the columns of "Barth", he not only designates it as being "extremely rare", but he also observes that had found but *one* single example of it.

Mr. Armitage, however, informed me that he had collected many specimens at *Gneina*; but he still considered it as being one of the rarest of the Maltese orchids.

I was somewhat surprised at this for in April last Rear Admiral Lord Walter Kerr, who is con-

siderably interested in the Maltese Flora, found two or three examples of the same plant in the valley of *Imtahlep*; and in the course of an excursion that I had with him to *Fiddien*, towards the end of April last, I collected a great number of these beautiful plants which were growing in the moist earth in the bottom of the valley.

Lord Kerr afterwards found other examples at Boschetto.

It appears that this has been an exceptional year for them; but I fear that if not "extremely rare", it will not be so easy to find them.

A. Caruana-Gatto.

Science Gossip.

In the course of some excavations in the marl beds near Wissenfeld, in Prussia, the remains of a huge prehistoric reptile were unearthed.

Unfortunately the workmen had dispersed the remains ere attention was called to the matter; but judging from the dimensions of the vertebræ and other bones that have been preserved, the animal must have been a leviathan in point of size. The remains have been taken to Berlin for identification.

Experiments are being made in Bavaria, and in the Hartz mountains for the purpose of acclimatising the reindeer. Should the government be successful in its endeavours, the introduction of these animals will be the means of creating a new, and a thriving industry for the peasants of the district, for not only may they be utilised as beasts of burden, and for agricultural purposes, but they are also very prolific, their flesh affords excellent venison for the markets, and they give an abundance of rich milk.

The sponge fishery season has recommenced at Lampedusa, and from the accounts that have reached us the results of the fishers promise to be highly successful from a pecuniary point of view. The sponges obtained from the banks are of a quality that is much sought after in the market, as they are not only much finer in texture but they arealso a colour equal to if not superior to the best of the Cyprus sponges.

The Government of Cyprus invite tenders for the sponge fisheries around the Island of Cyprus. These industries should afford excellent opportunities to naturalists for the study of Mediterranean Zoology.

The example, that has been set in Malta, by "The Society for prevention of cruelty to animals" might, with advantage be followed in many other countries around the Mediterranean. The Malta Society has given evidence of its intention to protect its dumb proteges by issuing to the public a neatly printed card containing full directions as to the course that should be adopted by a passer-by towards those that illuse their beasts.

The suggestions are thoroughly practical, and easily applied; and there can be no doubt but that if carried out impartially, they will be the means of considerably mitigating the sufferings of the beasts of burden of the islands.

Copies of the suggestions may be had on application to A. Caruana-Gatto Esqr., 31 Strada Federico, Valletta.

In the May number of the "Annals and Magazine of Natural History" the Rev. Canon Norman, F.R.S., has contributed an interesting article on the question as to the validity of *Cyclostoma* asa generic name in conchology.

After the annexation of Merv, a part of that territory, comprising about 386 square miles, was formed into a private estate for the Emperor of Russia. It lies 28 miles from the town of Merv and near the railway station of Baïram-Ali. About forty miles from this station an immense dam has nearly been completed to check the waters of the Murgab, which will be used for the irrigation of the property. Next spring, when the irrigation canals have been constructed, a fifth of the estate will be colonised. For this purpose Mohammedan settlers from Ferghana will be chosen, these being best able to endure the dry and hot climate of the Merv Oasis, where the thermometer often stands in summer as high as from 112° to 120° Fah.

Deutsche Rundschau Bd. XII.

In the quarterly proceedings of the Manchester Geographical Society there is a most instructive article by Mr. Gustav Jacoby on "British trade with Algeria, Tunis, and the Sahara, the principal object of which is to direct the attention of British merchants to those markets in Northern Africa from which the French are, apparently, bent on ousting us, if we will allow them.

The Archduke Ludwig Salvator of Austria has just issued a further instalment of his magnificent work on the Balearic Islands. The present volume contains an exhaustive descriptive account of Minorca.

The Potato Disease.—Two forms of disease exist in potatoes. One is caused by a fungus known as *Phytophora infestans*. In this the leaves shew brown spots, which, if carefully examined, exhibit a whitish border; this whitish down in the fungus in question. The leaf becomes flabby as the spot extends, and ultimately dies. The tuber itself remains hard, but shews brown spots and has a disagreeable taste when cooked. The other disease, in which the tuber softens, is caused by a bacterium known as *Closteridium butyricum*, a species which is able to dissolve the cell walls, and to develop, butyric acid, by which, however, the starch contained in the tissue is not materially affected. After the potatoes are dug up this last disease may be arrested by putting the tubers in a dry, light, airy place.

"La Neptunia" is the title of a new journal of natural history, that has lately been started at Venice. Among the many branches of natural science to which it is devoted, the following occupy a prominent place.

1. Physics of the sea, (bathymetrical, thermometrical &c.
2. Animals and plants of the sea.
3. Marine stations, laboratories, &c.
4. The culture of fish, and Ocean expeditions.

We strongly recommend this journal to all who take an interest in the natural and physical history of the Mediterranean and the adjoining seas.

Subscribers should address Dr. D. Levi-Morenos. S. Samuele 3422.—Venice.

An interesting discovery, consisting of a prehistoric burial-ground, containing implements and other remains referable to the stone-age, has been made in Isnello, in the province of Palermo, Sicily.

The general temperature of the Mediterranean from a depth of 50 fathoms down to the bottom is almost constantly 56° F. whatever may be the surface elevation of the bottom. This is a greater contrast to that of the Atlantic, which at a similar depth is at least 3° colder, and which at 1,000 fathoms sinks to 40° Fah.

Among the articles that will appear in our columns during the next six months are the following:—The tarantula of the Mediterranean. The physiology of the Carob tree. Recent foraminifera of the Mediterranean. The Natural history of Corsica. Plant resemblances. The Lepidoptera of the Maltese Islands. The Sirocco as an agent of denudation.

The Eruption of Vesuvius of June 7th 1891.

My suggestion that the second alternative type of eruptive activity would be that pursued by the volcano, which I published in several newpapers, has been fully confirmed. Now for a period of over a month lava has continued to dribble forth, activity has returned to the central vent and no great changes have occurred.

The throat of the volcano commenced to be cleared on June 9th, the vapour forcing its way up from the crater bottom at intervals through the choke of loose materials, and rose above as a column of dust; at the same time the powerful vapour blast issuing from the upper extremity of the lateral rift of which mention is made in my first letter. Each day I was kept informed of the state of the volcano by the kindness of Messrs Ferber and Treiber, the director and engineer respectively of the Vesuvian Railway.

On June 15th I considered it right to again visit the mountain, and had the good fortune to be accompanied by Messrs Elliot, Linden, Green, Newstead, and Treiber, several of whom are excel-

lent photographers so that with two of my own machines we were able to make an extensive pictorial record of some very unique formations.

We ascended to the point of issue of the lava at the junction of the foot of great Vesuvian cone and the Altrio del Cavallo. Here the first lava had cooled sufficiently to allow us to walk over it, but beneath our feet could still be seen, in a few holes, the flowing lava. At the foot of the great cone and extending for half was across the Altrio along the radius of the eruptive rent as if this had continued so far were a series of driblet cone fumaroles. We counted 7 complete and well formed examples, besides numerous abortive ones, (see Fig.) Most were giving out jets of intensely heated vapour which was liberated from the lava flowing beneath and which soon carbonized a piece of wood placed in it. Around the lips of the upper opening, hæmatite with fused chlorides of potash, soda, iron, copper, etc., were being condensed and trickling down the outersurface of the fumarole consolidated into curious variegated stalactites of very deliquescent nature.

The lava had first flowed towards the escarpment of Mount Somma in a fan like manner so that the eastern extremity reached that great natural section just beneath the Punta del Nasone. Still following the natural inclination of the ground it turned to the W. and on June the 15th. was opposite dyke 16 advancing at a very slow rate.

The lava is a vitreous and coarse grained rock especially in the included leucite crystals, whilst the surface is of the coarded or "pahochol" type. This is due to the magma being one that has been simmering since January in the chimney of the volcano, so that most of its dissolved H 2 O had been boiled off and so allowing it to cool without the formation of scoria from the vapour that otherwise would escape after its exit. Leucite I have also demonstrated to be formed while the magma is simmering under low pressure with free escape for vapour in upper part of the volcanic chimney.

See:—H. J. J. L.—The Geology of Monte Somma and Vesuvius, being a study in Vulcanology.—Q. J. G. S. Lond. Vol. XL. and Relationship of the structure of Igneous Rocks to the Conditions of their formation.—Sci. Proceed. R. Dublin Soc., Vol. V.

At the summit of the great cone the crumbling in of the edges was constantly going on but the upper extremity of the lateral rift at the foot of the cone of eruption and at the summit of the great Vesuvian cone had nearly ceased to give forth vapour. Along the line of rent on the mountain side no fumaroles or other signs of activity were visible except quite at the foot where those commence of which I have spoken.

Up till June 26th. there was a struggle to clear the upper part of the volcanic chimney of the impeding materials which were constantly being added to by the slips from the craters edge; but on that evening a dull red glow was visible in the crater bottom showing that a fairly clear passage had been temporarily made for the continuous escape of vapour, and also that the lava was at no very great depth from the summit of the volcano. This, of course, indicates that the lateral opening was insufficient to drain off much of the lava which occupies the chimney above the level of the lateral outlet. Had such evacuation really taken place the eruption would have assumed enormous proportions from the actual amount of lava above the tap, but more from frothing up of that below that level, in consequence of the relief of pressure that would then occur. Of course during all these days, the ejection of dust often took place giving the smoke a peculiar dark grey color. Further destruction of the crater edge again occurred so as to partly block the outlet, and it was not till our next visit that it again cleared.

On June 30th. I again paid a visit to the crater in company with my friend Mr. A. Green. All the summit of the great cone was covered by a thick coating of dust and sand upon the surface of which were the usual white and yellowish green chloride crusts seen in such occasions so rich in copper as to plate with that metal the iron nails of our boots. The crater had considerably enlarged, the edges were in an extremely unstable state with often considerable strips marked off by cracks parallel to the free edge, so that with a slight push with a stick, it was possible to detach large masses of the loose fragmentary materials which form the sides of the crater in the recent cone of eruption. So dangerous were the edges that it was but in two places that my experience indicated as being safe to approach and look over, and that even with several precautions, so that the accident to Senor Silva Jardina who accidentally lost his life is not to be wondered at.

On looking down some 45 to 50 m. beneath us, we could see the glow from a mouth some 2 or 3 metres in diameter. The walls of the crater were concave so that although overhanging at the top yet a plumb line let fall from the edge would strike the bottom of the cliff. The crater bottom was roughly plane due to the combination of a talus all round, and an attempt at a cone around the main vent. It will be thus seen that the crater cavity was of the form of a convex sided cylinder or simply barrel-shaped with its upper end some 45 to 50 m. in its maximum diameter at the top.

With much difficulty we made our way around to the north side of the cone of eruption which had now lost its usual loose scoria surface which was buried beneath a thick coat of sand and dust with a thin saline crust on its surface. The upper limit of the radial rift, which we were prevented from examining three weeks before on account of its giving out so much vapour as to constitute the temporary escape aperture of the volcano, had now become quiescent so that we could fully examine it. It only gave out a current of hot air, but I was able to collect some fine masses of crystallized Molysite and Kremersite from its edges. Its average breadth was about 0·50 m. where it traversed compact lava, but had disappeared as soon as the looser fragmentary materials were reached. The real azimuth of its orientation, which we could now determine with greater accuracy than when we were walking over hot rock and enveloped in hot irritating vapours, proves to be, as it radiates away from the axis of Vesuvius, about 15° W. of N. It curves then a little to the north, and near the foot of the great cone it again assumes nearly the same azimuth as at starting, an arrangement which is quite evident when the Vesuvian cone is regarded from the Punta del Nasone. From that, the highest point of Somma, the lower extremity of the rift lies a little to the right or W, and faces that part of the Somma ridge which corresponds to the extremity of the Vallone Cancherone.

As one stands on the Punta del Nasone and embraces that magnificent view of Vesuvius and the Atrio del Cavallo one sees at their feet the

new lava stream in the form of the letter **L** the horizontal portion of which is still being prolonged down the Atrio towards the Fossa della Vetrana.

In the morning of the 30th of June much dust had fallen at the lower railway station, of which we collected some bags full. It is the usual fine sandy material of these eruptions and consists of the pulverized materials of the cone of eruption.

Having passed the night at the lower railway station, the next day we crossed the Atrio, ascended to the W. extremity of the ridge of Somma, and followed this along so as get a general birds-eye view of the whole scene of the eruption, and take photographs of the more important points. In the middle of the ridge we found a thin coating of fine red dust, which had reached thus far from the crater. Much of the Atrio was also covered by the same material. Scaling the cliff face just beyond the Cognulo di Ottajano to the Atrio del Cavallo we again visited the lower point of outburst. Most of the beautiful fumaroles were in a state of ruin and lined by good sized cristals of haematite and mixed chloride crusts. Here the lava was quite solid though at one point was a hole some 50 m. from the base of the great cone, where we could see the molten rock flowing lazily along about a metre beneath our feet.

The lava of the end of the flow was making considerable progress to the westwards and stood opposite dyke 13.

Since then few changes have taken place in the mountain—the crater still gets larger, dust is thrown out and the lava descends. These phenomena are capable of continuing for months if the drainage opening does not enlarge. As the eruption progresses I will send your further details.

H. J. Johnston-Lavis.

Notes on the Recent Foraminifera of Malta

BY

E. A. Earland & J. H. Cooke.

STATION I.

The material from which the following foraminiferal forms were obtained was dredged from the French Creek of the Grand Harbour, Valletta, Malta, in 5 fathoms of water. It consisted of a tenacious, dark-blue, highly calcareous mud, that was made up of clayey particles intermixed with fragments of the remains of Gasteropods, Crustaceans, Echinoderms, Polyzoa, Ostracodes, Lamellibranchs, Calcareous Algæ, and small, starved specimens of foraminifera.

The creek is surrounded on three sides by the Globigerina Limestone, (the second formation in the ascending order of the Malta series of rocks), which is highly susceptible to atmospheric influences, and which, therefore, weathers readily.

This rock consists of about 80 per cent of Calcium Carbonate, nearly, the whole of which is made up of foraminifera. As the creek receives the drainage of an extensive area in which this rock predominates at the surface, a no inconsiderable quantity of the fossil foraminifera is periodically carried down and deposited with the recent forms in the bottom mud. Many of these were met with in the washings, during the after examination.

An analysis of a sample of the mud showed it to consist of 75 per cent of Carbonate of Lime, the other 25 per cent being made up of alumina, sponge spicules, diatomaceous forms, fragments of quartz, angite, felspars, coal-dust &c.

The following is the result of Mr. Earland's examination, and his notes on the specimens found.

The material contained a number of ostracoda and other remains, but presented few forms of interest, most of the foraminifera being rather poor specimens.

Forty-six species in all were determined from the small amount of material examined (about 2 ounces, the residue after washing, of several pounds of dredging).

The most noticeable forms obtained were:—*Bolivina nobilis*, *Hantken*. Several specimens referable to this species were discovered. They present all the characteristics of the form as figured in the Challenger Monograph, but are not very strongly marked. The species has only previously been reported in the recent state from the South Pacific, where it was found in several localities by the Challenger expedition. The original specimens were fossils from the Miocene of Hungary

Gaudryina filiformis. Berthelin. Several specimens, similar in appearance to the small variety found on the Irish coast by Mr. J. Wright.

Nodosaria calomorpha. Reuss. One very fine specimen, having four chambers, a very unusual number.

Spirillina vivipara. Ehrenberg. A good many specimens of this form were observed.

A considerable number of foraminifera were observed which were evidently fossils derived from the Miocene strata of the island. These included many of the commoner fossil forms, Globigerina, Truncatulina praecincta, &c. &c.

Several weak and doubtful specimens were also obtained from the gathering which cannot at present be assigned to any species with certainty.

A complete list of the foraminifera observed in the gathering follows. It should be noted that the words "Common," "Rare," etc. following a form, refer to its relation to other foraminifera only, and not to the bulk of the gathering, of which the whole of the foraminifera form only a small proportion.

No.	NAME		REMARKS
	MILIOLIDAE.		
1.	Nubecularia lucifuga.	*Defrance.*	Rare.
2.	Miliolina tricarinata.	*d'Orbigny.*	Rare.
3.	Miliolina bicornis.	*Walker & Jacob.*	Not uncommon.
4.	Miliolina fichteliana.	*d'Orbigny*	Very rare indeed.
5.	Miliolina trigonula.	*Lamarck.*	Very rare.
6.	Miliolina seminulum.	*Linnè.*	Common, but not typical.
7.	Miliolina subrotunda.	*Montagu.*	Fairly common.
8.	Miliolina (Siginoilina) secans	*d'Orbigny.*	One specimen.
9.	Spiroloculina grata.	*Terquem.*	Starved and poor. Common.
10.	Spiroloculina impressa.	*Terquem.*	Common.
11.	Spiroloculina excavata.	*d'Orbigny.*	Common.
12.	Spiroloculina nitida.	*d'Orbigny.*	Common.
13.	Cornuspira involvens.	*Reuss.*	Common, but small.
14.	Vertebralina striata.	*d'Orbigny.*	Rather common.
15.	Peneroplis pertusus.	*Forskal.*	Common, but poor.
16.	Orbitolites duplex.	*Carpenter.*	A few very small & poor specimens.
	LITUOLIDAE.		
17.	Haplophraginium canariense.	*d'Orbigny.*	Very rare
	TEXTULARIDAE.		
18.	Textularia concava.	*Karrer.*	One very weak specimen.
19.	Textularia agglutinans.	*d'Orbigny.*	Several specimens.
20.	Textularia gramen.	*d'Orbigny.*	Single specimen.
21.	Verneuilina polystropha.	*Reuss.*	Common.
22.	Verneuilina spinulosa.	*Reuss.*	One fine specimen.
23.	Gaudryina filiformis.	*Berthelin.*	Several small shells.
24.	Bulimina aculeata.	*d'Orbigny.*	One specimen.
25.	Bulimina marginata.	*d'Orbigny.*	Common.
26.	Virgulina schreibersiana.	*Czjzek.*	Not uncommon.
27.	Bolivina nobilis.	*Hantken.*	Very rare.
28.	Bolivina punctata.	*d'Orbigny.*	Common. Some specimens were marked with fant striae at the initial end, thus apparently marking a transition stage with the last form.
	LAGENIDAE.		
29.	Lagena sulcata.	*Walker & Jacob.*	One very poor specimen
30.	Lagena gracillima.	*Seguenza.*	Very rare
31.	Lagena laevis.	*Montagu.*	Uncommon.
32.	Lagena lucida.	*Reuss.*	Very rare. One found.
33.	Nodosaria calomorpha.	*Reuss.*	One extremely fine specimen.
34.	Polymorphina gibba.	*d'Orbigny.*	Very rare. One specimen.

No.	Name		Remarks
	ROTALIDAE.		
35.	Spirillina vivipara.	*Ehrenberg.*	Fairly common.
36.	Patellina corrugata.	*Williamson.*	Rare.
37.	Discorbina globularis.	*d'Orbigny.*	One specimen.
38.	Discorbina vilardeboana.	*d'Orbigny.*	Not uncommon.
39.	Discorbina valvulata.	*d'Orbigny.*	Rare and poor.
40.	Planorbulina mediterranensis.	*d'Orbigny.*	Fairly common.
41.	Truncatulina lobatula.	*Walker & Jacob.*	Common.
42.	Rotalia beccarii.	*Linné.*	Smalls specimens common.
	NUMMULINIDAE.		
43.	Nonionina scapha.	*Fichtel & Moll.*	Common.
44.	Polystomella striato punctata.	*Fichtel & Moll.*	Rare.
45.	Polystomella crispa.	*Fichtel & Moll.*	Several specimens.
46.	Polystomella macella.	*Linné.*	Rare but very typical.

NEWS OF THE MONTH

Prof. Crova lately communicated the results of his observations on the diffused light of the heavens to the Academy of Sciences of Paris. Crova has found that the blue colour of the heavens is most intense during the months of December, January, March and September, while it is the least so during the months of February, July, August and November.

The colour is the most marked in the morning, it becomes weaker in the warm hours of the day, and stronger towards evening. The differences are, according to Crova, due to the presence of dust in the atmosphere together with infinitesimally small globules of water, and also to the presence of a small quantity of vapour irregularly distributed through the air.

On the 7th ult. S. M. the King of Italy honored the Accademy of the Lincei with his presence and distributed the scientific honours of the year. The Natural Science honours were conferred on Professors Gestro, Piccone, Sacco, Tuccimei and Ricchieri.

The Deutsche Geologische Gesellscaft held their annual convocation from the 9th to the 12th of August last, at Freiburg in Saxony.

An International Geographical Congress assembled at Berlin on the 10th of August, and extended its sittings over four days.

Representatives of all of the principal Geographical Societies of Europe and America were present. Among the subjects that were brought forward for consideration were, the elaboration of a map of the world on a scale of 1-1,000,000, for the purpose of demonstrating how little is really known of the countries of Europe; a discussion as to the means that should be adopted to procure uniformity in the spelling of geographical names; and the adoption of an universal hour.

Erica Mediterranea:—This fine plant would seem to have fairly established itself in the British Isles judging from the recent accounts that we have received of it. Not only does it occur in abundance in the northern and eastern parts of Ireland, but it is also equally plentiful in the south east of England.

The Accademia delle Scienze dell'Istituo di Bologna offers a gold medal of 1000 lire value (£ 40) "to the author of a memoir based on certain data of chemistry, or physics for a new apparatus for the prevention or extinction of fires." The manuscripts must be ready before May 10th. 1892.

Books, &c. received.

International Review of Science—Journal of the Manchester Geo: Soc:—Nature Notes—The Naturalist—Quart:Journ: Geol: Soc: Lon:—Proc. of the Royal Geo: Soc:—Bolletino dei Musei di Zoologia Turin—Rivista Italiana di Scienze Naturali—La Rivista Medica—Le Naturaliste—La Farmacia—Science Gossip—Sulla forma della Terra, Dr. A. Calabrò-Lombardo—Monographia degli ofidi Italiani, Prof. L. Camerano—Prima contribuzione alla fauna lepidotterologia dell' isola di Malta—A. Caruana Gatto. B.A.—Revue Scientifique—Proceedings of the Smithsonian Institution.

Exchange Column.

Notices are inserted in this column free of charge. We request that all exchanges may be signed with name (or initials) and full address at the end.

Foraminifera and Crustacea from the Mediterranean offered in exchange for works on Nat: Hist: T. A. L. c|o Editor of Med: Nat: Highland House. St. Julians. Malta.

Microscope for sale. Mahogany case. $\frac{1}{4}$ inch and 1 inch objectives, one eyepiece. Editor of Med: Nat: Highland House, Malta

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Offered lantern slides, unmounted, of the geological, and picturesque features of the Maltese Islands in exchange for lantern slides, mounted or unmounted of other geological phenomena. M. C. care of the Editor of the "Mediterranean Naturalist" 48 Strada Mercanti, Valletta, Malta.

Wanted for cash or exchange, Hincke's "History of the British Zoophytes", Johnson's "British Zoophytes", and Pennington's "Natural History of British Zoophytes". The Editor of the "Mediterranean Naturalist" 48 Strada Mercanti, Valletta, Malta.

Wanted dredgings containing foraminiferous materials from any part of the Mediterranean, papers on the foraminifera, or good micro-slides. A. Earland, 3 Eton Grove, Dacre Park, Lee S. E.

Editor J. H. Cooke B.Sc., F.G.S. Malta.

THE MEDITERRANEAN NATURALIST.

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CONTENTS.

NOTICES.

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Special Notice to Readers.

Those of our readers who have not yet sent in their subscriptions are kindly requested to do so at an early opportunity.

To Correspondents.

All communications intended for insertion should be written on one side of the paper only; and should reach the Editor on or before the 12th of the month. Whenever an answer is required through the post, a stamped and directed envelope should be enclosed.

Secretaries of Societies are invited to forward us reports of their proceedings; and Curators of Museums will confer a favour by informing us of any new and important additions that may be made to their collections.

Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

The Natural History of Malta. *

By Rev. Prof. Henslow, M.A., F.L.S., F.G.S.

THE Maltese Islands are seven or more in number. Malta, the largest, is fifteen miles in length and seven and a half broad; Gozo, next in size, is nine by five miles; Comino, about a mile long; Cominetto about half-a-mile; Salmone, close to the scene of St. Paul's shipwreck, can be crossed in three minutes; Filfola, three miles from the south coast, is about 800 yards long; the sole quadrupedal inhabitant of this little rock is a bronze-black variety of the green Lizard, so common in Malta. Lastly, the General's Rock, an isolated fragment of Gozo, is noted for the *Cynomorium coccineum*, or "Fungus Melitensis," a curious flowering parasite, closely resembling in shape the fungus Coprinus.

They are all composed of limestone, with one intercalated layer of Marl. Geologists separate the strata into, (1) Lower Limestone; (2) Calcareous Sandstone (really a slightly siliceous limestone); (3) Marl; (4) Upper Limestone; all being of Miocene age. The only other epoch represented is the Quaternary, by the Cave fauna. The beds incline from N.E. and E.N.E.; agreeing with the Sicilian and Apennine chains. Though the beds are marine, they indicate the proximity of land by the presence of the Halitherium, Dugong, Manatee, Seals, Crocodiles, &c., found in the strata. About 20 species of fossil fish occur, including an abundance of teeth of the large *Carcharodon Megalodon*, and of smaller sharks' teeth, e.g., the book-toothed *Corax aduncus*, *Oxyrhina* (3 sp.)&c., popularly called St. Paul's teeth. Of Mollusca, about 75 species are known, including ten *Pectens*, four *Scalarias*, and four species of *Nautilus*. The *Terebratulœ* have three species. Echinoderms are largely represented; 45 species being known, in-

(*) *Abstract of a lecture delivered before the Ealing Scientific Society.*

cluding nine of *Clypeastus*. A fine bed of coral occurs on the south cliffs.

The relics of the caves and fissures representing the quaternary fauna are remarkable. A gigantic swan as well as many land and water birds; fresh water turtles, two feet in length and a large lizard; *Hippopotamus Pentlandi*, *Elephas Mnaidræ*, *E. Melitensis*, *and E. Falconeri*, the last two being pigmies four feet in length; and an enormous Dormouse about the size of a half grown rabbit. These constitute the principal remains found.

Of the caves in which these remains occur some are on the summit of the cliff facing the south, 300 to 400 feet above the sea. Others are inland.

A red earth enclosing the bones and teeth has also filled gaps or fissures in the limestone rock, when the whole of the terrestrial surface was denuded. Water-worn pebbles are found in some of the caves as well as stratified soil and stones. A large "swallow-hole" shewing proof of running water in the smooth and channelled walls is now situated on the slope of a sleep hill near the end of one of the harbours of Valletta.

To reproduce the original conformation of the land, when the above animals were alive, we must imagine the bottom of the old Miocene sea to become dry land, Europe and Africa being united, the site of the Mediterranean constituting a low lying country with large rivers, lakes, swamps, and forests. The land subsequently sank, the Atlantic found its way in, and as far as Malta is concerned completely denuded it down to the bare rock. On rising again Malta formed the extremity of a peninsula united to Sicily; but 100 fathoms of water still lay between Malta and Africa. Malta now became peopled with a Sicilian Fauna and Flora. One more subsidence of some 70 fathoms, isolated the Maltese islands.

The land slopes gently northwards in the direction of Sicily, but terminates very abruptly by a large fault running parallel to the south coast, which rises precipitously to several hundred feet above the sea.

Numerous other faults shew indications of some violence in the separation and disruption of the Maltese islands; and it is remarkable that seismic phenomena are not now in sympathy with Etna so much as with the volcanic disturbances in the Greek Archipelago.

The existing Fauna.—Of mammalia there are 20 species, including seven bats, the hedgehog, weasel, and ferret; Norway, water, and common rat, mouse, rabbit, scale, and four cetaceans. Of Reptiles there are two harmless snakes,* four species of lizard, a sea tortoise, and a frog. Of birds there are only ten permanent residents: but a great variety of migratory birds visit the islands. There is a large rookery, but, a there are no trees, the rooks build in the precipitous rocks on the south of the island. Of land shells there are about 40 species, the freshwater are about 20 in number.

The existing Flora.—The plants are purely Sicilian, one only not being known out of Malta, Centaurea crassifolia, a fleshy leaved plant, growing in the rocky sides of a valley, and bearing pink heads of flowers. Oxalis cernua, from the Cape, was introduced in 1806, and a late arrival, of about ten years residence, has established itself within the fortifications of Valletta, namely, a "Crucifer" of the name Enarthrocarpus pterocarpus, from N. Africa.

As there are no woods, meadows, or swampy places, except a few in miniature, perennials are less numerous than annuals, though many species propagate by bulbils, &c. The indigenous flora is distributed over three kinds of districts, viz., cultivated fields, together with road sides; the "Wieds" or uncultivated narrow gorges or valleys, and uncultivated rocky surfaces. Of the more remarkable plants, the following may be mentioned. In the fields occur the purple Anemone coronaria; "Love in a Mist," Nigella Damascena; white Mignonette, Reseda alba; crimson Gladiolus segetum; several species of pink, and white flowered onions, Allium; sp.; the Feather Hyacinth, Bellevallia camosa, a crimson corn-salad, Fedia cornucopia, &c. The roadsides and waste ground afford such plants as the ubiquitous yellow Oxalis cernua, single and double; three species of Marigold or Calendula; the Borage, Borago officinalis; a white flowered Henbane, Hyosciamus albus; the squirting cucumber, Ecballium Elaterium the Annual Daisy, Bellis annua; a pink Catchfly, Sirene cericea; a small buttercup, Ranunculus bullatus; the annual Mercury, Mercurialis annua; and three nettles, but not our common Urtica dioica, are most abundant.

* *The Maltese have a tradition that St. Paul, like St. Patrick in Ireland, drove out the venomous snakes!*

The exposed rocky places supply Capers, Capparis spinosa, the garden Stock, Matthiola incana; the wall pellitory Parietaria, officinalis, which covers the rocks and walls in every direction; a variety with leaves like the poplar, var, "populifolia," seems peculiar to Malta. Great quantities of the pink flowered Heath, Erica multiflora, and the "polyanthus" Hyacinthus Tazetta are brought to market. Inula crithmoides, a shrub with yellow composite flowers and fleshy leaves, resembling furze-bushes in the distance, abounds along the rocky coasts. It is upon this as a host plant that the parasite Cynomorium lives. Magnificent thistle-like plants abound, as Cynara cardunculus, with enormous leaves, as well as the Acanthus mollis, the foliage of which is represented on the Corinthian capitals. Labiatæ are well represented. a large flowered Phlomis fruticosus as well as the garden sage, Salvia officinalis, and Rosemary, Rosmarinus officinalis, both pink and white varieties; a dwarf Iris, Sisyrinchium, and the little purple Romulea bulbocodium are everywhere; a tall white flowered Asphodel, Asphodelus ramosus; a Sarsaparilla, Smilax aspera is a common prickly climber over walls and rocks; the Medicinal Squill, Scilla maritima and its ally, sicula are abundant. The white Lily, Lilium candidum was a native, but it has been exterminated by florists, and is only occasionally seen by the houses of peasants. Of Orchids, there are nine species of Ophrys, *e.g.* O. bombiliflora and O. fusca being particularly abundant; the spider Ophrys less so, and the bee Ophrys is very rare. Nine species of Orchis occur.

The largest orders are Leguminosæ, which includes 17 species of clover, Trifolium, and Umbelliferæ which has 22 genera and 32 species; illustrating the well-known feature of island floras, that the proportion of genera is large in comparison with the number of species; thus in this order there are 1·5 s.p. to each genus.

Of cultivated trees, the only which is universally distributed is the Carob, or St. John's Bread, Ceratonia Siliqua; but as the land is so exposed they are stunted, with much twisted boughs. In some of the deep valleys they grow to a respectable size.

Dates and the dwarf Fan Palms are few and far between, as the former cannot ripen its fruit, and the natives object to all superfluous trees as abstracting nourishment from their crops. Figs, mulberries, oranges, and lemons, are the principal trees cultivated.

Note on "Dioplodon farnesinœ."

We have received the following interesting communication from Professor P. J. Van Beneden of Louvain.

J'ai l'honneur de présenter á l'Académie un exemplaire d'un nouveau Mémoire fort intéressant du professeur Capellini: il a pour objet un rostre de Ziphioïde fossile découvert dans les environs de Rome, et qu'il rapporte á une espèce nouvelle, sous le nom de *dioplodon farnesinœ.*

Ces travaux sur les Ziphioïdes ont pour nous un très haut intérêt. On sait que dans le vaste ossuaire des environs d'Anvers, les Cétacés de cette famille dominaient, et il importe de pourvoir comparer ceux qui habitaient le bassin de la Méditerranée avec ceux du bassin de la mer du Nord.

Nous savons aujourd'hui que la mer Noire possédait, á la fin de l'époque tertiaire, des baleines qui lui étaient propres; la géologie nous a appris aussi que le détroit du Bosphore n'existait pas alors et que ces Cétacés pouvaient aller prendre leurs ébats dan les eaux de la mer Arctique.

Nous savons également aujourd'hui qui la mer Noire n'a plus aucun Cétacé propre et que les trois dauphins qu'elle renferme, originaires de l'Atlantique, n'ont pu pénétrer dans cette mer intérieure que depuis la formation du détroit de Gibraltar et du Bosphore.

The climate of Cephalonia.

The climate of the Greek island, Cephalonia has been lately described by Dr. Partsch in *Peterminn's Mittch.* Among the many details which the learned doctor there gives, the following are perhaps some of the most interesting. At Angostoli the temperature reaches a maximum in July of 25°. 3. Cen, whereas at Corfu and Patras it does not get so high as this until August. After several days of calm and bright sunshine the air becomes ladened with moisture, and the atmosphere is then hot, close, and unbearable. Yet the

natives go but little to the wooded hills behind, where the temperature goes down sometimes to 15°. 5. cen. or lower, even on the hottest days. Mules bring down snow mightly in summer from covered pits in the hills, to supply the restaurants and hotels. As to rain, there is a sharp contrast between the wet winter half, and the dry summer half of the year. The registered rainfall shows (3 ½ inches) for the latter against 36 inches for the former.

The autumn rains are ushered in by severe thunderstorms. November, and December are the wettest months, but about Christmas there is usually a short spell of fine weather. March is extremely variable, and often very wet. With May begin the rainless months, and the drought sometimes lasts considerably over a hundred days. Five months have sometimes passed with but a slight shower. Snow seldom falls in Angostoli, but it often falls on the hills. Dew is plentiful in summer, and is often very injurious to the crops owing to the salt precipitate that it forms. Wind is greatest in winter, southerly and southeasterly winds especially prevailing. A hot south-wind (the lambaditta) blows in the early summer, and it has a prejudicial effect upon the vegetation. The fresh north-east wind (the maestro) is the most invigorating, and it is usually accompanied by dense masses of cumulus cloud which clothe the the hills around.

T. M.

Theories of Mountain Formation.

By T. Millard Reade, C.E., F.G.S., F.R.I.B.A.

Part II.

THE first requirements of a geological theory are that it should conform to, and explain observations made in the field.

No speculations, however ingenious, are of much value in a geological sense if only deductively arrived at; hence a first requisite in the elaboration of a true theory of the origin of mountain ranges is an intimate knowledge of their geological structure.

The careful observations of eminent geologists over the accessible portions of the known world go to prove that the universal characteristic of mountain ranges is the enormous thickness of the sedimentary deposits of which they are composed.

This fact was first brought prominently forward in connection with the Appalachian chain by Prof. James Hall, of New York; and it is no less true of the Rocky Mountains, the Andes, the Alps, and the Caucasian, Himalaya, and Ural Mountains. Of these, we possess the most knowledge of the Alps and Appalachians, the combined thickness of the various formations of which they are severally composed being estimated by competent geologists at from eight to ten miles. It is a true generalisation that the necessary preliminary to mountain building is great previous sedimentation. This, as all know who are at all acquainted with the principles of geology, means the destruction of so much land elsewhere, combined usually with the accretions from volcanoes either in the form of ashes or lava streams, or both. It is also none the less evident to the student of geology that this, again, means the lapse of enormous periods of geological time.

When we come to consider in what way these various strata are arranged in mountain chains, we find, as a universal fact which there is no gainsaying, that strata which have been aqueously laid down in approximately horizontal positions are in the regions of mountain ranges thrown into folds, and sometimes bent, contorted, and twisted into the most extraordinary convolutions.

The one opinion now held by geologists and physicists is, that these effects are mainly due to lateral pressure, but, as I have already shown much difference of opinion exists as to the origin of this pressure. Not only are solid rocks folded into loops, but as a general rule—to which there are only a few exceptions known, and these I think are more apparent than real—there is in each great range a central core composed of gneissic and granitic rocks, which often expands towards the summit, throwing the sedimentary beds through more than a right angle, producing an actual inversion of the strata, and what is called in geological parlance, "fan structure." It is rocks of this nature that at present are, and for some years past have been, the subject of much interesting study and controversy.

The age and origin of these foundation rocks are not by any means yet settled, but whether composed of metamorphosed sediments, or whether they are volcanic complexes altered and made

schistose by pressure, or are partly granitic intrusions, it is evident to anyone practically familiar with dynamical principles that they have been subjected to enormous pressure deep down in the earth, and have been thereby forced up, behaving under such pressure in most respects like plastic bodies.

It will be seen from this only too short description that the characteristics of great mountain ranges are in the regions of the ranges, great foldings of the strata, semi-plastic intrusions forming the central, or what formerly was the central core of the range, often enclosing the sedimentary folds in a manner expressively likened to "button-holes," and frequently, in addition, intrusions of true granite, and trappean or igneous dyke-rocks. These folds are, excepting in the case of those buried in the earth, truncated by erosion and atmospheric influences, so that even in geologically recent ranges as much rock has apparently been removed as that which remains above the general surface level; while, in the case of older chains, such as the Urals and the Appalachians, the remaining portions are mere worn down stumps. This is the case with our Snowdonian and Cumbrian mountains, and still more is it so with the mountain fragments of the Highlands of Scotland, as irrefragably proved by the labours of our modern school of geologists, and the further fruitful labours of the survey since it cast off the meshes of the supposed succession of rocks woven and left us as an informal legacy by the late Sir Roderick Murchison.

In addition to folding there has been discovered in these North-west Highland regions an extraordinary series of lateral dislocations and reversed faults which appear to be unique, and the effect of adaption by shearing instead of folding, to changed conditions of space resulting from enormous lateral pressure.

If however, we travel transversely from the centre of a great range, on one side if not on both, after crossing the outcrop of the strata and the "foot-hills," we find that the beds which in the range proper are bent and contorted into violent folds take on more gentle undulations as we recede from the mountains until they recover in the plains an almost horizontal position.

Travelling *towards* the mountains, there is usually a gentle and long ascent before we reach their base—a feature noticeable in the eastern approach to the Andes and the Rockies, and also the French approach to the Alps.

I have now, I think, said sufficient to show the intimate connection that exists between the building up or accretion of strata on the earth's crust, and their after formation into mountains.

But what are really the relations of one to the other? Are they one of cause and effect?

The upholders of the "contraction" theory recognised them as such, and met the difficulty by saying that the *locus* of accumulation is necessarily a weak place in the bosom of the earth, and therefore the earth's crust in crushing-in squeezed and folded the unconsolidated deposits instead of the hard rock existing elsewhere. This is an explanation it will be well to consider before broaching my own views on the subject. At first sight it certainly seems to possess the defect of being too neatly contrived to meet the difficulty. It assumes what is not proved; for all great areas of sedimentation must, if the hypothesis be true, be weak places in the earth's crust.

Nature, unfortunately, is not arranged on so beautifully harmonious a system; and if we on the true principles of geology inquire into what is taking place on the earth now, we have no grounds to suppose that such *selective* areas—if I may use the term—are those to which sediments are universally carried. On the contrary, there appears to be an impartial distribution of sediment dependent on a vast variety of factors, either or in addition to any that may be traced to a local weakness of the earth's crust. As I have elsewhere shown*, the North Atlantic is now receiving directly or indirectly the drainage and detritus from about twenty-one millions of square miles of land, or more than one-third the total land area of the globe. On the American or western side, on which there must now exist beneath the surface of the ocean enormous geologically recent and, so to speak, unused deposits, we have some of the most stable land on the globe, as instance the Archæan Crystalline rocks of Canada and the Brazils, while between them we have the volcanic and unstable basin of the Gulf of Mexico receiving the drainage of the Mississipi. When we

* *Origin of Mountain Ranges*, p. 308.

consider that the earth throughout as a mass is declared by such good physicists as Sir William Thomson and George Darwin to be as solid as steel from the surface to the centre, it would seem rather foolish to search for specially weak places under sedimentary areas. If, however, it could be shown that lateral pressure consequent upon the shrinkage of the under-layers of the earth's crust, and acting only to the depth of a few miles below the surface—that is, to the level-of-no-strain—is capable of piling up the crust into mountain ranges, the explanation is a feasible one, as no doubt the upper layers of mere sediment would be weaker than the surrounding buttresses of old rocks.

The structure of all great ranges, as known through the labours of geologists the world over, negatives this supposition, and shows that we must seek for a deeper-seated force than that derivable from the secular contraction of the globe. What can this force be? It was shown long ago by Babbage, Scrope, and Herschell that the laying down of beds of sediment must produce a rise of temperature in the rocks below. Borings, well sinkings, and mining have shown that as the earth is penetrated the temperature rises, and this is true of new deposits as well as of old rocks. Many observations have been made of the rate of increase of temperature, which show that it varies to the extent of 1° Fahr. in 28·1 feet at Anzin, in the North of France, to 1° in 157·2 feet in the Minas Geraës Mines in Brazil. There is a regular but slow outflow of heat taking place from the earth, so that when a sedimentary layer or covering accumulates at any locality on the earth's surface, all the layers of that sediment eventually get heated to the normal temperature due to the depth and the conducting power of the rock.

Thus, for example, if the rate of increase is 1° in 60 feet, a deposit 6,000 feet thick would become eventually 100° hotter on the under side or base than at the surface, and all intermediate depths would take their proportionate temperature.

Planes of equal temperature in the earth's have been called *iscgeotherms*. It is not an attractive-looking word, certainly, but the authorities having adopted it all we have to do is to follow suit, especially as the word expresses an exact thought. It will thus be seen that the laying down of sediment first affects the temperature of the immediate underlayers, but eventually it is felt to profound depths. Now what will be the effect of this rise of temperature on the portion of the earth's crust so affected? Everyone knows that heat expands and loss of heat contracts substances, but in varying degrees. To determine the amount I made a series of experiments on various rocks, and I found that the mean linear expansion was 2.77 feet per mile for every 100° Fahr. In small pieces of rock very exact and minute measurements are necessary even to detect *any* alteration of dimensions, the change of bulk being proportionately small; but when the dimensions are magnified so as to include sections of the earth's crust the change of bulk is measured by cubic miles. This, like many other things, is all a matter of *relation*, and it takes time and thought for the tyro to accustom himself to think that great effects can from little causes spring. If, however, there is one thing which geology teaches the patient investigator it is not to despise apparently small forces. We see this every day, yet we learn not. Every one-hundredth part of an inch of rain means one ton per acre. A ton seems a great deal when collected together, whereas one-hundredth of an inch seems beneath notice. So it is with the forces of expansion; by alteration of temperature they pass unnoticed until some large structure is dependent upon these forces being effectively provided for. A hot sun on one side of the Menai or Britannia tube will twist it three inches laterally and two and a-half inches vertically where it is free to move. During the very hot summer of last year the rails of many railways had to be taken up and shortened, although it is customary to allow for expansion at each joint, and the holes of the fish-plate bolts binding them together are made slightly oval to meet the difficulty. No large engineering work is properly designed unless provision is made for meeting the changes of bulk caused by changes of temperature. Metal plates for roofing, such as in lead gutters and flats, have to be laid in sections so as to be free to move, for, if soldered together in one length, they will soon tear themselves to pieces.

Notwithstanding these precautions, all old lead gutters and flats are full of wrinkles and ridges, produced by infinitesimal changes, which end in the forcing up of these ridges. Each expansion by

increase of temperature bends the lead a little, while the contraction caused by decrease of temperature does not bring it back to its original form. Who has not noticed the ridges in a lead-lined bath or sink? These are due to the same cause, and are the accumulated effect of frequent minute changes caused by expansion and contraction.

But how do these familiar facts bear upon the "Origin of Mountain Ranges?" It will be my object in the next article to show this.

(To be continued.)

Preservation of Algae.

Having been perfectly successful in preserving the colour of many of our fresh-water algae, it may be that the same method would prove successful with desmids. My plan is simply to have a wide mouthed bottle, with a glass stopper, filled with distilled water in which I have placed a number of pieces of camphor.

When it is desired to mount the algae I place a portion of the same in some of this camphor water, to which a few drops of glycerine have been added, in a watch glass.

At first it will become a yellow, lemon colour, but after a few hours the original green returns in its full vividness, and then I at once mount in the cell with a portion of the fluid.

A specimen of *Draparnaldia plumosa* mounted 20 years ago in this way is today as beautifully green as at first, and the chlorophyl seems to be unchanged.

W. H. Walmsey.

Sir Warington, W. Smyth, M.A., F.R.S.

The death of this celebrated naturalist, the brother of His Excellency Sir H. A. Smyth, K.C.M.G., R.A., the present governor of these islands, has left a gap in the ranks of scientists that it will be difficult to fill up.

His scientific work in Asia Minor, Syria and Egypt placed him in the front rank of Mediterranean Naturalists, and paved the way to those posts of honour which he afterwards so worthily filled. The estimation in which he was held by his brother-labourers may be well guaged by the following brief account of his career which was given by Dr. A. Geikie LL.D., F.R.S., at a recent meeting of the Geological Society of London.

Warington W. Smyth was born in 1817 at Naples, where his maternal grandfather, Mr. Thomas Warington, was British Consul. His father, Admiral W. H. Smyth, F.R.S., spent many years in the Admiralty Survey of the Mediterranean. He wrote papers on astronomical and geographical subjects, as well as separate works on Sicily and the Mediterranean, which marked him out as one of the most scientific naval officers of his time. The son was sent home to be educated in this country, and was placed at Westminister and Bedford Schools, subsequently entering at Trinity College, Cambridge. Endowed with a constitution of rare vigour, and a passion for active exercise, he threw himself with ardour into the sports of the University, formed one of the winning University Crew in 1839, and as "head of the river" rowed with such energy as to be nicknamed "the steam-engine."

Leaving Cambridge with a travelling bachelorship, he spent more than four years in journeying over a large part of Europe, extending his rambles into Asia Minor, the borders of Kurdistan, Syria, and Egypt. Having already begun to look with interest on minerals and rocks, he made it one of his main objects in this prolonged tour to visit mines and to see for himself how the various ores occur in nature. His sojourn in Germany and Austria gave him the opportunity of making the acquaintance of such men as Humboldt, Von Buch, Von Dechen, Naumann, Haidinger, and Von Hauer. At one time he is found attending lectures on Mineralogy; at another time he is to be seen exploring coal-fields or descending silver-mines, or pushing his way through salt-works, or ransacking bone-caves. Again we hear of him among the rugged sunburnt rocks of Monte Cristo or encamped with Waltershausen near the summit-snows of Etna. A winter on the Nile is followed by a more adventurous ramble through Palestine and Northern Syria to Aleppo and the Upper Tigris. This prolonged absence abroad not only gave him a wide experience of practical mining-matters, but afforded him opportunities of cultivating that familiarity with foreign habits and foreign languages which made him in the end an ideal Foreign Secretary for a Geological Society.

Returning to this country in 1844 he made the acquaintance of De la Beche, Director-General of the Geological Survey, who, with his intuitive perception of the merits of a good man for his purpose, soon engaged him as Mining-geologist on the staff of the Survey. In that capacity Smyth made explorations in England and Wales and in Ireland, besides mapping some districts with his own hand. When a few years later (1851) the School of Mines was organized, he was appointed Lecturer on Mining and Mineralogy, and he continued to give his mining lectures down to the very end. His wide knowledge of all that relates to the extraction of minerals from the crust of the earth led to his being called on to undertake many additional duties. He was appointed Chief Mineral Inspector to the Office of Woods and Forests, and also Mineral Inspector to the Duchy of Cornwall. Besides acting as adviser to the Crown in all mining questions, he was often requested to give his services on Committees and Commission. He was appointed Chairman of the Royal Commission which, in 1879, was formed to enquire into the subject of accidents in mines, and he had the main share in drawing up the voluminous Report of the seven years of enquiry spent in this laborious and important investigation. It was more especially in recognition of this service that he received the honour of knighthood in 1887.

All through life one of the busiest of men, he yet had the happy art, by quietly keeping his toils in the background, to seem to be possessed of ample leisure ready to be placed at the service of any frinds who wanted to talk with him or any student who sought his advice. Always on the outlook for additions to his knowledge and ever ready to impart to others what he had gained himself, he seldom cared to publish what he knew. Early in life he wrote an account of his wanderings in the East, which appeared in 1854 under the title of "A Year with the Turks." A few memoirs by him, chiefly on mineral veins and mining localities, found a place in the "Memoirs of the Geological Survey" and the "Transactions of the Geological Society of Cornwall." He wrote also occasional articles, such as that on Mining in Ure's "Dictionary," likewise a small but standard Treatise on Coal and Coal-mining, of which the seventh edition appeared last year.

Up to within the last year or two of his life he showed but little sign of advancing age. His step seemed as light, his eye as keen, his mind as active as in his early days. But a weakness of the heart began to make itself felt and forced him to abridge some of his more fatiguing duties. He came to the evening gathering of the Royal Society last summer, where he looked perhaps better than he had done for some time previously, and talked in his old cheerful way. Next morning, 19th June, sitting in his library with his students' examination-papers before him, he quietly passed away, dying as he had lived, in harness.

It is not from the bulk, nor even from the intrinsic importance of his published work, that the services of Sir Warington Smyth to the cause of science are to be estimated. More efficient and widespread, perhaps, than the influence of his writings, was that of his personal example and teaching. Every year he sent forth a body of students trained by him in the habits of careful observation, of cautious induction, and of manly outspoken honesty which were his own distinguishing characteristics. These men, scattered all over the world, carried with them the impress of his instruction, and no more unalloyed pleasure ever came to him than the tidings that his pupils had done him credit in the career on which he had started them.

Among the beneficent influences of his honoured life we Fellows of the Geological Society count those not the least which he exerted for us during his long and intimate association with us. He joined our body in 1845. For more than thirty years he served on our Council filling successively the offices of Secretary, Vice-President, and President, and for the last seventeen years sitting at the Council-table as Foreign Secretary. In every capacity in which he could be useful to us he was ever ready to give us the benefit of his experience and wise counsels. We mourn his death with sincere sorrow, and though "the sweet benefit of time" will doubtless soften our regret, we shall never cease to remember with affectionate regard the distinguished colleague and the generous-hearted friend whom we have lost in Warington Smyth.

Vine and Olive culture in Algeria.

Among the many dangers that beset the viticulture of Algeria, the most formidable are those due to atmospheric disturbances. In spring, hailstorms frequently destroy the young shoots, the flowers are often ruined by fogs, and the ripe fruit by the sirocco.

Another serious enemy is the *Phylloxera*, but the officials have been fairly successful in dealing with this pest. Another is the *Altise*, a small beetle which causes great destruction, particularly when in its larval condition. The mode of killing the *Altise*, commonly adopted is to place bundles of grass and vine cuttings around the yard when winter is approaching; in this the insects conceal themselves in large compact masses, and the whole is then set on fire.

Other diseases, the oidium, anthrachnosis, peronospera, and chlorosis. It is calculated that the want of intelligent treatment of these diseases causes the owners of the vineyards to lose annually nearly a third of the crop.

The olive seems to grow everywhere in Algeria except in marsh ground, and attains dimensions quite unknown on the northern coast of the Mediterranean.

H. E. Brun.

Deforestation of Servia.

Servia is rapidly being disafforested, and from the reports that have lately been made it seems that the most lamentable effects are already following on the great want of foresight that has been shown.

Since the declaration of Servian independence, the Servian peasants have cleared vast tracts of land of the fine woods with which they were formerly covered, for the purposes of agriculture, and the usual consequences of drought in summer and heavy floods in winter are already beginning to manifest themselves.

The government have endeavoured to interfere, but most of the restrictions that they have passed have been carried out in such a perfunctory manner that their statutes are considered but as a dead letter.

The south and the south-west of Servia contain the finest supplies of timber, and it is from these districts that the greater part of the oak staves that are used in cask-making, are obtained.

At Vrania, along the Turkish frontier, there are some magnificent oak forests; while the fir, the juniper and the walnut thrive luxuriantly on the great Kopavnik Range, and on the heights of the Nischava valley, and Zlatibor.

Remarkable natural phenomenon near Cephalonia.

BY

W. G. Foster.

On the western side of the Bay of Argostoli there is a heaving rock, which, unchanged by the roughest or calmest weather, rocks to and fro with the regularity of a pendulum. It is separated from a fixed mass of rock against which it opens and shuts in its perfect motion; at one time it will jam a knife in the crevice, from which in a few seconds, extraction would be impossible, whilst the next moment you can easily insert your hand when its maximum aperture has been reached.

The phenomena has been carefully examined by many scientific men, divers have been sent below to ascertain if it be the result of a detached rock from a neighbouring cliff having fallen on to another and thus becoming very finely balanced, as all logan stones usually are.

However it was not only shown to be a perfectly solid rock, but it does not require the motion of water to sway it, as so often we find it erroneously stated, the motive power for swaying it being furnished by an apparently inexplicable cause.

Nearly opposite to this rocking stone, another remarkable phenomenon is to be found, consisting of a body of water, equal in bulk to about a million gallons per day, running in from the sea at four points on the coast rapidly for a certain distance until it gradually becomes sucked into the earth and disappears. By conducting the water into an artificial canal for a few yards, and by collecting the four points of supply into one enough motive power is obtained to drive two mills. The stream after being thus utilised, is allowed to follow its own course, and is lost among the rocks..... It has no possible outlet.

Zante.

Observations on the Geology of the Maltese Islands.

BY JOHN H. COOKE.

(continued.)

Of the caverns that have been formed by the action of rain, wind, and the atmosphere, the most interesting and picturesque are those that occur, like the marine caves, in the highest and lowest of the series of the Maltese formations. These often take the form of mere excavations in the limestone escarpments, that have been worn out by wind and rain; but oftener still they occur as long tunnel-like apertures, that have either been formed along a softer vein of the rock by the action of underground water, or have had their origin in some fissure that has afterwards been enlarged by the combined action of air, rain, and running water.

Of this latter class the "Ghar Hasan" cave may be considered as being typical. It is situated on the southern coast of Malta, and it consists of a funnel shaped dilatation, with several fissures and smaller tunnels branching off from its extremities and sides. Three of these branches are of a size sufficient to allow of a person traversing them; but passage through the others is impracticable on account of its narrow dimensions. These larger branch fissures also ramify in various directions, and in several cases the ramifications return upon the main branch, and thus form circular and elliptical courses.

There are three entrances to the cave, all of which abut, on the cliff face, but access is practicable to but one, that which forms the mouth of the main cave: the others can be approached only by making a detour of the branch fissures.

The contour of the cave walls, and the irregular manner in which the projecting crags and bosses of the cave have been worn, as also the character of the heavy yellow clay which covers the bottom of the cave would seen to indicate that the passages owe their origin to the action of running water. Even in the summer time a copious supply of dripping water finds its way into the cave, while in winter a miniature stream, meanders onwards and precipitates itself over the cliff into the sea. Most of the water finds its way into the cavern through the numerous swallow holes with which the roof is perforated, and which are no doubt in connection with the surface.

The cave commands a fine view of the Mediterranean; but considering the difficulty, not to say danger, that is attendant on obtaining access to it, it is questionable whether the pleasure that is to be derived from a visit is commensurate with the trouble and risk that must be incurred.

Intermixed with the clay that strews the bottom, are larged quantities of recent bones referable to species of doves, gulls, bats, and rats such as at present find a sheleter and a home with-in its precints.

Fragments of pottery, too, are abundantly strewn about; but they are all of an apparently recent type.

The remoteness of its situation and these evidences of its having had occupants at some time or other, have been held by the country-people, to be of sufficient importance to entitle the cave to a prominent position in their legendary lore, but in this instance the reference is of an historical, rather than of a supernatural character. The cave is supposed to have once served as a retreat for a notable Saracen sea-pirate, who continued to live in Malta for some time after the edict had been passed for the expulsion of his fellow-countrymen.

In the valleys of Marsa-Scirocco, Uied-el-Hasel, Uied-in-Citta, Uied Siggieui, there are numerous caverns of a similar character, but none of them are as large as Ghar Hasan.

Most of these caves owe their origin to the action of underground springs, the waters of which, after percolating through the surface strata have found a passage into the rock fissures, and, by enlarging them, have formed these cavities and tunnels. It is to these numerous underground excavations and the breaking in of their roofs that a large majority of the minor faults that occur in the Globigerina Limestone are due.

One of the most remarkable of these depressions is that which occurs in the vicinity of the villages of Crendi, and which is known as "Makluba."(*)

It assumes the shape of a cylindrical hollow and forms the centre of what was once an elevated plain, that extended from Casals Safi, Monkar, and Agathe to the sea.

(*) *Makluba signifies, "overturned."*

This elevated tract of ground is now of a basin-like shape, the sides of which slope inwards and culminate in a sudden downthrown.

The sides of the hollow are perpendicular, and extremely rugged; and they show here and there, distinct scorings, that appear to have the character of "slickensides," which have been caused by the friction of the opposing strata in its descent.

Access may be had to the bottom by means of a series of rudely fashioned steps, that have been cut in the sides for the accomodation of the great number of visitors that annually go to the place.

Covering the bottom there is a rich alluvial soil, in which the carob, the cactus, and the fig-tree flourish luxuriantly all the year round.

According to the traditions of the villagers the chasm marks the site of a village, which in times, past, was visited by Divine Wrath as a punishment for the manifold offences of which the inhabitants had been guilty and therefore, from that time to this, the place has been known as Makluba or the "overturned."

Such is the legend that is connected with it; the geological facts are, however, much at variance with the villagers' folk lore.

Leading immediately from the hollow, and running southwards in the direction of the sea, are two fissures, which extend for some considerable distance into the Lower Limestone. They were, probably, formed prior to the formation of the underground cavern which caused this sinking in of the superior deposits; and thus their existence facilitated the ingress of the water, which, saturated with carbonic acid, eroded the cave, and also assisted its egress, when it was ladened with the eroded material. A large underground cavern was thus formed in the limestone, the roof of which was, in consequence of the magnitude of the dimensions of the cavern, left in a very unstable condition, and it was thus rendered susceptible to the least movement.

A shock may have been given by an earthquake, which, by enlarging the fissure already formed, caused the undermined stratum to obey the laws of gravity, and to descend to the level at which we now find it. The total area occupied by the cavity is about 70 square yards.

At Dueira in Gozo, there is a similar depression; but it is on a much grander scale than is that of Makluba. A huge circular fault has there brought all of the superior deposits to a depth of 200 feet below the surface level of the Lower Coralline Limestone. On the western side the Lower Coralline Limestone cliffs have been eaten through by the sea and a small bay has thus been formed the only outlet of which is the tunnel that perforates the cliff sides. Active denudation of the remnants of the beds IV, III, II and I, that still exist within the depressed area, is even now going on and that so rapidly too, that in a comparatively short space of time, no trace of the former presence of these beds will be left.

Unlike the Makluba hollow, the downthrow has not been uniform all round, as is shown by the height of the cliffs that surround the depression.

Thus while those on the eastern side, tower to a height of 200 feet, those on the western side are but 50 feet high. This great difference is partly due to the decided westerly dip that the Lower Limestone here takes.

On the western side, access to the bottom of the depression may be had by means of a broad, easy gradient that leads down to a beach of shingle, pebbles, and boulders. Judging from the general contour of the surrounding area, and the manner in which the depressed upper deposits that lie within, have been worn away it would appear as if a considerable volume of freshwater had formerly here found an outlet into the sea. Such a torrent would have assisted considerably in the perforation of the cliff face, and it is only by the means of such a torrent that the five-sixths of the basins that is now almost empty, could have been so effectually cleared of all of the Marl, Greensands, and Upper Coralline Limestone debris that formerly existed in it. Even now the waters of the Kaura Gorge, a steep, and rugged valley are periodically poured down the old waterway during the winter time; and they still carry on the work of erosion.

The district for some miles around has been much faulted and broken up; and it should be visited if only for the wildness, and uncouthnes, of its scenery. It has a bold ruggedness and a barren wildness such as are not to be met with in any other part of the islands.

The fantastic architecture, and bold outlines of the General's rock, and its outliers; the variegated

hues of the lofty mural cliffs of Ras-il-Wardia, that here attain the maximum height of 450 feet, and that,

"Rise like ramparts all along
The blue sea's border."

the tremendons down-throw of the strata of the Dueira Basin; these, together with the cold, neutral grey of the rock masses, relieved by the rich, warm colouring of the patches of soil that here and there chequer the surface, and the hill sides, when bathed in the purple and crimson rays of a Mediterranean sunset, combine to make up a scene, which contains all of the essential elements of the sublime, and picturesque.

Unlike most limestone districts, the Maltese area is singularly deficient in any really fine examples of cavernous excavations.

The reasons for this I have already stated are due primarily to the lithological character of the strata.

At Gozo, however, there is a small but very interesting example of a stalactite cave, and being the only good example of the kind in the island, it is therefore the more noteworthy.

It is situated on the "Ta-Sciara" hill, in the vicinity of Mars-el-Forn Bay, Gozo, and as it was not discovered until the latter part of the year 1888, it is, therefore, still in a good state of preservation.

It is located under a field, that is in close proximity to the village church of Sciara; and access may be had to it, by means of a hole in the surface, and, also, by a door way.

Both of these entrances have been built by the farmer in possession, since the discovery of the cave, for the accommodation of the numerous tourists that annually visit the place; for though small, it contains within its limited area, "shapes and forms" that are at once the wonder and admiration of all who behold them.

To obtain entrance, a descent of about 16 feet is necessary, but there is no difficulty attendant on this, as the series of steps, that have been cut in the rock, renders the task both an easy, and a convenient one.

The known dimensions of the cave are about 80 feet in length, and about 60 feet in width; but, judging from the numerous smaller caverns and tunnels, that occur around the sides, it would appear as though it extends over a much greater area.

When lighted up with tapers, or with magnesium wire, the interior presents a very charming and picturesque appearance.

Suspended from the roof, like icicles hanging from the branches of a tree after a severe frost, are thousands of crystalline, semitransparent stalactites, the colours of which range from a snowy white to a deep golden yellow.

Through the sides and roof of the cave, a never failing supply of lime-charged water, slowly finds its way, and decorates, with living pearls, the pendants and traceries that hang around. As the light of the tapers is thrown on these, and on the encrustations of lime that stand out, in many places, in bold relief from the smooth, alabaster like sides both of the cave and of its columns, the light, that is reflected, sheds a softness and mellowness around, that has the effect of causing the background of the cave to appear as though it were hung with the most delicate of crystalline draperies.

Rising from the floor in yellow pyramidal masses, that gradually taper off as a clear translucent white, are countless stalagmites, many of which are still undergoing the processes of formation; while others have united themselves with the pendant stalactites, and have formed fantastic columns, from whose irregular, and strangely fashioned sides, the light scintillates and sparkles with the brilliancy of diamonds. In the middle of the cave, several of these columns have attained exceptionally large proportions. Many of the pendant stalactites do not descend in a perpendicular direction, but they curve slightly towards one another, and tend to form festoons, the loops of which, sweep in graceful curves in every direction.

And to what causes may we attribute the origin of this fairy-like grotto? "Every thing in nature," observes the great essayist, Emerson, "is engaged in writing its own history;" and, it is a remark, that expresses in terse, and definite language, a rule to which we can find no exception.

The autobiography of this cave is as plainly written, as though it had been inscribed in a book, —as indeed it really has been—for what is nature, but a book, that is replete with the most wonderful histories, and the most beautiful imageries,

The cave owes its origin to the chemical action of the carbonic acid gas, which is held in solution by the rain water, that percolates through the limestone roof. Pure water, when alone, has but little effect on lime; but in conjuncton with carbonic acid, it is peculiarly destructive. The rain that descends upon the hills of Malta and Gozo obtains a supply of this gas from two sources. It absorbs it, though in inappreciable quantities from the atmosphere; and, after its descent, it obtains it from the vegetable matter, with which the surface of the ground is covered. The humus, formed by decaying vegetable matter, evolves large quantities of this gas; and, as it is very soluble, it is readily seized upon and absorbed by the water. In this particular instance the overlying soil is thickly planted with cactus, and it is from the decomposition of this plant that the water obtains a large proportion of the gas, which afterwards enables it to do its work so effectively.

By the action of this acid, the insoluble carbonate of lime, of which the limestone is largely composed, is converted into a soluble form, which is known to chemists as bi-carbonate, and in this form it is held in solution until the water evaporates, and redeposits it as an insoluble carbonate again.

It is to this redeposition of lime that the formation of these beautiful though fantastic columns, is due.

Facing the Ramla valley, on the eastern side of the same hill, there is an example of another cavern, that had a somewhat similar origin; but, which cannot be compared with "Ta-Ninu" either in its form and dimensions, or the beauty of its contents. It shares, with another cave at Melleha, the honour of being supposed to be the traditional grotto, in which the goldess Calypso held her court, and carried on her amours with Telemachus.

The spot has been immortalised alike by Fénélon in his work "Aventures de Telemaque," and by Homer in the fifth book of the Iliad, where the great poet thus describes it:—

"Large was the grot in which the nymph he found,
The fair haired nymph with every beauty crowned,
She sat and sung: the rocks resound her lays;
The cave was brightened with a rising blaze;
Cedar and frankincense, an odorous pile,
Flam'd on the hearth, and wide perfumed the isle;
While she, with work and song the time divides,
And through the loom the golden shutter guides.
Without the grot, a various sylvan scene
Appear'd around, and groves of living green;
Poplars and alders ever quivering play'd,
And nodding cypress form'd a fragrant shade
On whose high branches, waving with the storm,
The birds of broadest wing their mansion form;
The chough, the sea-mew, the loquacious crow,
And scream aloft, and skim the deeps below.
Depending vines the shelving caverns screen,
With purple clusters blushing through the green.
Four limpid fountains from the cliffs distil.
And every fountain pours a several rill,
In mazy windings wandering down the hill:
Where blooming meads with vivid greens were crowned,
And glowing violets spread their odours round;
A scene, where, if a god should cast his sight,
A god might gaze, and wonder with delight."

But where are now the "groves of poplars, and of alders", the "limpid fountains and the mazy windings"!

But for the commanding view of the island, that is to be obtained in its vicinity, the toilsome walk, that has to be undertaken to reach the place, would certainly not be repaid by the amount of pleasure, that a sight of this commonplace rock excavation would afford. The stern reality is rendered even more disappointing on account of the description in which the poet has immortalised it, and the historical halo in which he has enshrined it.

(To be continued.)

The Syrian Greyhound.

J. E. Harting.

The Syrian Greyhound is a very beautiful specimen of the race: smaller, and with less length of limb than the English Greyhound, and consequently with a shorter stride, the rapidity of his movements and the toughness and tenacity of his muscles, render him no unworthy scion of the stock to which his British cousin belongs.

Moreover, his long, feathery, tufted tail seems to act as a rudder to him, when in full flight across those breezy plains—an advantage which marks the difference between the Syrian and other greyhounds, to whom, in other respects, he bears the closest affinity. In the eyes and faces of the choicest specimens of these dogs there shines an expression of winning and almost human intelligence; yet, once launched in pursuit of game, they are as bloodthirsty as the sleuth-hound.

The dog in Egypt, as throughout the East, with this exception, is a homeless and houseless vagabond, and semi-savage, prowling in packs, acting as scavenger only, and never domesticated, because considered "unclean," by Mussulman law and custom.

The Prince Halim had the courage to brave this prejudice, and kept his greyhounds for the chase. But he also kept another and more curious class of creatures for the hunting of the Gazelle, probably the fastest in its movements of any wingless animal, viz., hunting-hawks, which seemed the genuine descendants of the "falcon gentle," which was wont to afford such rare sport to our ancestors in the Middle Ages.

The hawk used for this purpose is not the ordinary large Egyptian one, which hovers over the city of Cairo, poised in air on its wide wings, or circling around in search of quarry, but a smaller and fiercer bird, desert born and bred, with keen eyes and sharp talons, of which the larger brother stands in wholesome awe. These birds, trained much as were the mediœval falcons, seem to love the chase as much as their master, although their quarry be not the Heron, but the Gazelle.

Their services were only brought into requisition after the chase had continued some time, and as an adjunct to the pursuit of men, dogs, and horses, all concentrating their energies against the life and liberty of the most lovely, graceful, and inoffensive of wild creatures, almost the sole tenants of these arid wilds. After advancing a few miles into the desert, which presents one flat, dead, unbroken level of hard gritty soil (not sand), unrelieved by any shrub, grass, flower, or tree, bounded only by the horizon, and producing almost the illusion of a sea view, suddenly half a dozen slender, shapely forms spring up, and stand in bold relief against the sky, with heads erect, like statuary, some half mile distant. The sight seems at once to infuse new fire and vigour into the horses, dogs, and men, all of whom are immediately launched like thunderbolts in the direction of the quarry, which, pausing, motionless for a moment, breaks into full flight the next, bounding marvellous distances at each spring, and soon leaving even the fleet greyhounds toiling hopelessly in the rear; the distance between them visibly increasing, as the tireles Gazelles almost fly forwards inspired by fear. The scene now becomes most animated, exciting, and picturesque, with the floating burnouses of the Bedouin or Egyptian riders, and the gay attire of horse and man, and the gallant Arab coursers stretching out to full speed with expanded nostrils and protruding eyes, and the feathery tails of the Syrian greyhounds waving like banners as they bound after the flying Gazelle. But vain are the efforts of all their enemies to gain upon, or even to keep pace with, the graceful children of the Desert.

Horses, men, and dogs are falling rapidly behind; and even the forms of the Gazelles are becoming indistinct, and with difficulty discernible, except to the eagle eyes of the Prince and his Bedouins, when a new ally is summoned to the assistance of the hunters, and a new foe launched at the heads of the triumphant fugitives. Rising in his shovel-stirrups, in full career, with the grace and dexterity of an Eastern rider, Prince Halim, slipping off the hood from the head of the hawk he carries on his right hand, with a peculiar shrill cry launched the bird into the air in the direction of the fast disappearing quarry. Thus released, the hawk circles rapidly upward until almost lost to sight, a mere speck suspended in blue ether, and seemingly motionless in the cloudless sky, blazing under the fierce Eastern sun in a flood of light. A moment later the hawk can be seen shooting downwards like a lighting flash on the Gazelle, buffeting its head and blinding its eyes with the rapid blows of its strong wings. Almost frantic with fear and fury the Gazelle soon frees itself from its feathered assailant by striking its head upon the ground, and then resumes its flight; but the relief is only momentary, for the pertinacious assailant as soon as shaken off renews the attack, coming down on the antelope's head

again and again, releasing it only long enough to avoid being crushed or impaled upon its sharp brow horns. Blinded at last and wearied by these attacks, confused by the cries of the approaching huntsmen, the terrified and exhausted Gazelle falls an easy prey to the Greyhounds and pursuing horsemen. Sometimes a young or badly-trained bird would fall a victim to his interference; for the efforts of the Gazelle to destroy, as well as to shake off, his tormentors, inspired by the instinct of self-preservation, are often as energetic as piteous to witness." The reader is not told what species of hawk is thus employed, but it is evidently not the Goshawk, for it is described as circling rapidly upward until almost lost to sight. The flight is that of a falcon, and unless there be some poetic license in the description, which it is difficult to conceive if the author were really an eye-witness of the sport, it must be a falcon of some kind that is used, and a powerful one too. The Peregrine would scarcely be strong enough; it has nothing like the grip of the Goshawk, as I know from having carried both. The Icelander or the Jerfalcon would, in all probability, not be obtainable; the Lanner and the Barbary Falcon would be too small. What, then, is the species?—*Nat: Hist. Rev.*

Science Gossip.

The following is the areage of the principal islands of the Mediterranean.

Sicily 10,500 sq. miles.	Corsica 3337 sq. miles.
Sardinia 9,000 sq. miles.	Crete 3320 sq. miles.
Cyprus 3584 sq. miles.	

The last few months have been an anxious time for the olive, grain, and almond growers of Algeria, and Morocco, on account of the irreparable losses that have been inflicted by the ravages of the locusts.

The evil is, however, not altogether an unqualified one, for the natives, both Jews, and Mahommedans, largely use the insects as food.

The locusts are collected in bags, and are taken into the towns, where, after being boiled in salt and water, they are parched over a clear fire.

The flavour of the insect, thus dried, is by no means disagreeable, but resembles to a great extent, the flavour of the prawn.

To the *Cornhill* for August Mr. Grant Allen contributes a most interesting article in which he points out that it is a great mistake to suppose that it is in the tropics only where nature furnishes the most gorgeous floral display.

"As a matter of fact, people who know the hot world well can tell you that the average tropical woodland is much more like the dark shade of Box Hill or the deepest glades of the Black Forest. For really fine floral display in the mass, all at once, you must go, not to Ceylon, Sumatra, Jamaica, but to the far north of Canada, the Bernese Oberland, the moors of Inverness-shire, the North Cape of Norway.

Flowers are lovliest where the climate is coldest; forests are greenest, most luxuriant, least blossoming, where the conditions of life are richest, warmest, fiercest."

We beg to call the attention of our readers to the "Special Notice" on the first page of this number.

The article on "Cyprus" by Lieut. General Sir R. Biddulph, G.C.M.G.,C.B., will be continued in our next issue.

At the last meeting of the Geographical Society of Berlin Dr. Kretschmer delivered his report of the results of his studies and investigations in the Italian libraries for cartographical material of the Middle ages.

He was successful in discovering several "wheel and compass maps," that have hitherto been unknown. It is the intention of the Society to publish them in connection with the celebration of the 400th. anniversary of the discovery of America.

The *Thernomoretz*, a Russian survey ship under the direction of M. M. Schlindler Androussoff, and Wrangel, is about to start on an expedition of exploration in the Black Sea. No expense has been spared by the Russian government to insure the success of the expedition, and it is consequently expected that the scientific results will be of the highest importance.

The connection that has been established between the Indian Ocean, by way of the Red Sea, and the Mediterraneon, has been the means of partially restoring the former physical conditions of the Mediterranean Area.

Of late years most marked changes have been noted in the climate of the area; the average mean degree of humidity is now much higher, and the extremes of temperature are more marked, while the Sirocco instead of being an occasional, is now a constant visitant to the shores.

The fauna, too, is undergoing remarkable changes, and it is now a not unusual occurrence to find the Great White Shark of the Indian Seas, which was until lately quite unknown in these regions, disporting itself in the waters of the Eastern basin of the Mediterranean. The waters of the Adriatic are especially favoured by these unwelcome intruders, owing no doubt to the more equable temperature of its waters.

During the late naval manœuvres, a specimen of the white shark was caught that weighed four tons, and that measured 33 feet in length.

Our contemporary "La Neptunia" contains a brief, but interesting account of the equipment of the Italian war ships "Scilla," and the object of the proposed scientific expedition in the Mediterranean in which it is about to be engaged.

The 255th. anniversary of the foundation of the University of Utretch has just been observed with great pomp and magnificence.

A correspondent writes, "It may interest those of your readers who take an interest in the ornithology of the Mediterranean, to know the birds that are the most commonly met with in the eastern basin. While anchored in Besika-Bay a violent thunderstorm broke over the ship at about 7 a.m. after which the rigging of the vessel literally swarmed with birds among which I discermed Turtle-doves, Swallows, Grey-headed Wagtails, Titlarks, Whinchats, Striated Bunting, Shearwaters, and Cuckoos.

Up the Dardanelles the most common birds appeared to be the Shearwater, and a very pretty gull with a black-head, and bright red legs and beak. I shot one of the latter, and am taking the skin home with me."

The Geological Society of Italy have organized a series of excursions to Sicily to take place during the month of October.

On the 2nd. 3rd. and 4th. of the month, Taormina will be made the head quarters, and numerous trips will be made in the neighbourhood for the purpose of examining the local formations.

On the 5th. instant the party are to proceed to Catania; and on the following day Etna is to be explored.

The 8th. instant is to be spent among the scientific institutions of the Sicilian city; while from the 9th. to the 12th. instant will be taken up with visiting and studying the various strata of Monte Pellegrino, Palermo, and Lercara, Further particulars of the programme may be had on application to Prof. R. Meli, 51, Via Teatro Valle Roma.

A quarterly review, which is to be entirely devoted to the geology of Italy is about to be published at Rome under the direction of Messrs M. Cermenati and A. Tellini. The annual subscription is five shillings. Address "Rassegna delle scienze geologiche—Roma."

Editor J. H. Cooke B,Sc., F.G.S. Malta.

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Subscriptions are now due.

Special Notice to Readers.

Those of our readers who have not yet sent in their subscriptions are kindly requested to do so at an early opportunity.

To Correspondents

All communications intended for insertion should be written on one side of the paper only; and should reach the Editor on or before the 12th of the month. Whenever an answer is required through the post, a stamped and directed envelope should be enclosed.

Secretaries of Societies are invited to forward as reports of their proceedings; and Curators of Museums will confer a favour by informing us of any new and important additions that may be made to their collections.

Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

Notes on Some Natural Resemblances.

BY

F. P. Marrat,

Free Public Museum, Liverpool.

During observations extending over a large number of years, I have been much interested in noticing the curious and pleasing fact that certain specimens in different groups of natural objects resemble each other so greatly that the mind of the student is at once struck with the reflection—May not the whole have been mollelled after the plan of a few originating types? The examples which I am about to give in this paper are only selected from such objects as readily present themselves, without paying any regard to the relation-ship or the affinity that might be supposed to exist amongst them. All that is aimed at is the general resemblance which they bear to each other.

The materials from which these observations have been drawn are contained in the drawers of some of the table-cases exposed in the Free Public Museum, Liverpool, and may be seen in Bird Rooms Nos. 1, 2, and 3 on the right hand side of the Stone Gallery, which is reached at the top of the stone steps facing the entrance.

Taking, firstly, the Mineral Kingdom, we find but few examples here afforded for comparison in consequence of the rigidity of most of the species. A single specimen of Chalcedony in my own cabinet is the only one that may be said to resemble a plant. This piece is remarkable for its general resemblance to a tree fungus, known to botanists as a *Polyporus*. Everyone is acquainted with those curious dendritic markings so frequently seen on the various slates, leptinites, old red sandstones, &c. A charming specimen occurs in the second case on the left hand side of the centre space of the Phillip's Collection in the Liverpool Museum, in which white Gotham marble forms the *base* and the beautiful dendritic black oxide of manganese the picture upon it. Landscape-marble, ruin-marble, and ruin-jasper are other examples which may be enumerated in passing. The radiated brown sulphate of Baryta, known as Devon marble, much resembles a section of wood, and, indeed, is often mistaken for fossil wood.

From the extraordinary variation occurring among the Fungi, we should naturally except that some of the species would be found to resemble certain forms in other natural kingdoms. The beautiful little "bird's nest" fungus *(Crucibulum vulgare)* is wonderfully like a small bird's nest,

with the eggs lying at the bottom; indeed, it would not be too great a stretch of imagination to suppose that it represented the nest of a tiny humming-bird. The sponges, too, which spring up in an almost endless variety of forms, supply us with many typical examples. Thus, the "bird's nest" sponge (*Labaria hemispherica*) closely resembles the actual nest of a bird, not only in form, but in the loose texture of the interior. Two other allied sponges, *Halteria Carpenteri* and *Pheronema Grayi*, are each of this type. Another of the sponges, *Spongia infundibulum*, is fashioned on similar lines to those of the coral, *Turbinaria crater*, both being funnel-shaped. A number of sponges and corals also occur of cup-like or variform shape which are by no means rare, and each of these two groups often exhibits bottle-shaped, calabash and pod-like variations. It does not always follow, as a natural consequence, that resemblances between one living from and another should only arise in closely-allied groups; thus we have the following examples selected from the gorgonids:—*Pterogorgia*, *pinnata*, *petechizans*, *&c.* which resemble the plumes of a bird.

Again, the *Paragorgia arborea* (a northern form of Gorgonid) closely resembles a piece of ginger; whilst the *Phyllogorgia dilatata* has the external form of an oak leaf, and the dainty *Xiphogorgia anceps* in its growth might be compared to some of the narrow leaved ferns.

The narrow, clavate stems of almost any species of the coral genus *Seriatopora* have representative types in the genus *Clavaria*, a fungus. Another form of fungus is so translucent that, in general appearance, it could serve to place side by side with some species of floating, jelly-fish, such as *Aurelia*, *Chrysaora*, or *Rhysostoma*. The large masses of semi-circular coral, known as "brain-stones," are very much like the labyrinthic meandering markings of the brain. Again, one of the lowest order of corals, *Millepora alcicornis*—so named from the numerous small pores that dot its surface—has several resemblances. It resembles, in the first places, the palmated horns of the elk, and almost every species of deer could find a small set of horns similar to its own amongst the varieties occurring on the rocky sea shore where it is found. *Stylaster* is another very beautiful genus of coral, which, if it were not for its brilliant colours, we might place near the prickly gorse bush. *Lophoseris*, with its rounded, lobed, and radiated branches is by no means unlike the *polyperi* of our trees. Two other forms, *Primnoa* and *Caligorgia* might be compared with the light and open work in the feathers of the heron or egret. *Antipathes* is also much like those last mentioned, but partakes more of the appearance of stiff, bushy, and shiny shrubs. The red coral (*Corallum rubrum*) resembles a strong, thick repeatedly-branched red tree, the tips of its branches being peculiarly sharp pointed.

Certain corals have the margins of their orifices sharp, meeting at various angles—such as may be seen in the *Priomastræa tesseritera*—a plan which is repeated in the sponge *Tuba plicifera*. Another coral type, *Dichocœnia pulcherrima*, consist of a series of united tubes, having the margin of the apertures rounded as if folded inwards, and a very similar group of *Zoanthids* is found to occur in the genus *Palythoa*.

Numerous examples might be given of the long slender-branched sponge; but I will only mention a few of the best known instances:—The fresh-water *Spongilla fluviatilis* occurring in the canals and ponds near Liverpool, and the *Halichondeia oculata* (a species found in the Mersey).

Trees have also representative forms in a group of corals named *Dendrophyllia*, amongst which are the Mediterranean coral coral *Dendrophyllia ramosa* and the black coral *D. nigrescens*. That marvel of beauty, *Madrepora echinata*, and several species in the genus *Oculina*, are tree-like in form. Cup-shaped corals, sponges, &c., are comparatively common, one of the largest, as well as the best known species is Neptune's Cup-sponge. Fan-shaped corals and sponges are not so numerous, the former being usually rather small, but they form an interesting group for the student. The Chinese *Flabellum paroninum*, or peacock's-tail coral, and the following sponges—*Spongia flabellum* and *flagelliformis*, are representatives. In the *Zoanthid* series we find some remarkable specimens, one of which—the *Remilla Americana*—has all the appearance of a fungus with the stem placed in a side slit of the pileus. Those very remarkable objects, the Sea-pens, resemble—as their name implies—a blunt quill with its side feathers.

Although we may not be able to say that certain generic groups always possess any striking likeness to each other, still, the following resemblance in the mode of supplying the progeny who live in closely-allied groups is interesting. The shells of a certain genus of stationary mollusca, the, *Yenagoda*, are perforated on one side from top to bottom, so that the water may pass into the tubes of the animal without its being compelled to crawl out. In the coral genus, *Distichopora*, an external and perforated slit performs the same office; that is, it conveys water and food without the necessity of moving from its house. Another coral, the prickly *Echinophora*, would well compare with of the cactus tribe; the circular depressions in the plant, surrounded with radiated, needle-like spines, are by no means dissimilar from these in the coral. I do not think that these pines, either in the coral or the plant, may be viewed as defensive weapons, because the coral has as many holes bored in it by its enemies as most other corals have, and the cactus plant suffers quite as much from the animals which feed upon it as most other plants do.

We can hardly regard this subject in the light of "Mimicry"; at all events, it seems impossible to

assign any useful or protective purpose to the fact that one natural object possesses a strong resemblance in *form* to another in a totally different group. Perhaps a more careful study of the subject may throw some light upon it, and we may then hope to find a solution to this rather difficult question.

I have simply called these "natural resemblances," because in the present state of our knowledge they appear to be nothing more noteworthy.

In this subject there is full scope for work in a new field, and one that is certainly not likely to soon come to an end. In pointing out the variable nature of the objects in the foregoing observations it will not be the first time that my pen has announced the fact that endless variation is the rule, and not the exception to the rule in Nature.

The Mineral Springs of Roumania.

The mineral waters of Roumania have long been noted for their medicinal properties. They are of three kinds, ferruginous, sulphurous, and alkaline; and they are not confined to any particular locality but are found in every part of the kingdom.

The springs of Préidal and Cornu in the district of Prahova contain both iodine and bromine in abundance. With the exception of the springs at Cozia, which has a temperature of 75° centegrade, all of the waters are quite cold.

The following is the description given by M. Pierre Poenar of the Salt Lake Balta-Alba, at the end of his account of the mineral riches of Roumania. This lake is situated at 12 kilomètres (about 7½ miles) from the town of Rimnik-Sarat, in the middle of a vast plain; it is 7 kilom. (about 4½ miles) long, and varies in breadth from two to three hundred mètres; its depth is from one to two mètres only. The water of this lake is very salt, and forms saline deposits on the borders, where it is of a reddish-brown colour, and nauseous to the taste, on account of the multitudes of its aquatic birds, whose excrement (guano) is constantly driven upon the shores, At a few yards from the side, the water is very clear, colourless, and odourless; but has a strong saline taste, though rather bitter. Its specific gravity is 1.112; and its mean temperature 19° Centigrade (15° Reaumur). The bottom of the lake near the centre is level, very firm, and sandy; whilst the shores present a bottom of black greasy mud, exhaling constantly an odour of sulphuretted hydrogen. This mud contains the remains of the numerous aquatic plants which cover nearly the whole surface of the water in the shallower parts. It is much used in cutaneous diseases, rheumatisms, scrofula, &c. The mud is applied to the affected part, and is allowed to dry in the sun. This treatment is repeated several times in the day; and a bath is taken in the lake at night and morning. The lake Balta-Alba appears to owe its origin to subterranean springs passing through some of the layers of salt spoken of above. Its water has been incompletely analysed: it contains chloride of sodium and sulphate of soda, with a little carbonate of lime and sulphate of magnesia.

Diseases of the Mediterranean Orange.

The extent to which the systematic culture of the orange tree is practised in the regions around the western basin of the Mediterranean is so great, that the export of the fruit constitutes one of the principal and most lucrative industries of the district.

In Southern France, Spain, Italy, Sicily, and many of the Islands of the Mediterranean, large areas of land are devoted to the cultivation of the groves; and a large percentage of the population of these districts is dependent upon the results of the yearly crops for their means of subsistence.

The many variable circumstances, that affect the growth and the propagation of the orange-plant, render its cultivation but an uncertain mode of livelihood. Of these, the most common are causes, having their origin either in the climatic or geognostic peculiarities of the country, or in diseases that have been induced by the presence of insectivorous or other animate foes. So extensive indeed, have been the ravages of these and other causes of a similar nature, that the damage done has often been the origin of the most widespread misery among the cultivators, in consequence of the incalculable loss that has followed the failure of the crops. Capital and labour have alike been involved, and have alike suffered.

Latterly, however, the attention of the scientist, as well as of the capitalist has been drawn towards the subject; and now, considered from a utilitarian point of view, no branch of research can be said to have had more careful thought bestowed upon it, or to have been productive of more real good to society, than that which relates to the study of practical entomology.

Insect-pests, have ever been one of the greatest evils that the agriculturist has had to contend with. Between the members of the animal, and the vegetable creation there are many and striking resemblances, of which the tendency to tentative disease and ultimate decay is, perhaps, not the least remarkable. Plants, like animals, are healthy or unhealthy according to the conditions under which they are called into existence, and according to the methods that are employed in bringing them to maturity. Like animals, too, they are, liable to diseases, the characteristic symptoms of which are sometimes exhibited externally, and admit of a ready application of suitable remedies; and sometimes are so obscure, that a skilful diagnosis founded on an intimate acquaintance with the nature, structure, and habits of the plant is necessary, before either the cause or the remedy can be known. Rapid strides have been made in this direction of late years, though, paradoxical

as the assertion may appear, it is nevertheless, a fact, that nowithstanding the scientific methods that are now employed in the cultivation of plant life, that both the number, and the severity of the diseases that the modern agriculturalist has to combat, are much more formidable than those with which his predecessors were troubled. The system of unduly forcing, and of over fertilissing the plants is in a great degree answerable for this, for by creating conditions that are opposed to the natural processes, the plants are thus predisposed to diseases, which as time passes, get more varied in their forms, and more intensified in their effects.

The modern systems, too, often interfere with the balance of Nature by destroying not only the injurious insects, but also the parasites, birds, and animals that are their natural foes, and that would, if not interfered with, tend to keep these scourges in subjection.

The rapid means of transit that now exist between different parts of the world, and the extensive interchange of commodities that naturally follows are also instrumental in fostering and disseminating disease. It was thus that the scale insect *Icerya purchasi*, which made such havoc in the orange groves of Cape Colony a few years ago, found its way among the Californian fruit trees; and it was thus that the Hessian-fly was transported from the United States to the cultivated regions of Europe.

The devastation that insect pests have wrought during the last thirty years has not been confined to any one family of plants, or to any special region of the globe; though certain families appear to have suffered more severely in particular localities than in others.

Judging from the stastistics that have been given to us by such authorities as Hubbard of the United States, and Miss Omerod of Cape Colony, the Mediterranean fruit in general, and the orange in particular, is more liable to disease than is the fruit of Florida, California, Cape Colony or any other great fruit growing centre.

The reasons for this incongruity will be more apparent after a brief consideration of some of the most common of the forms of disease.

An abnormal condition of the Mediterranean orange plant is invariably marked by unmistakeable evidences of disease, of which the splitting of the fruit, the searing of the leaves, and the constant falling of both leaves and fruit from the tree are of the most frequent occurrence.

As a rule, such signs as these are but the premonitory symptoms of worse evils; but, if they be but properly and methodically treated, a temporary cure may be effected.

This form of disease is of frequent occurrence in the orange groves of Malta, Sicily, Barbary, and Italy, where the equable climatic conditions that prevail, tend to promote the longevity and the propagation of the parasites *(Hemiptera)* to whom the mischief is due. Though they are inveterate enemies to the mealy bug *(Dactylopius)*, another orange scourge, yet the havoc that they create by puncturing the fruit and causing it to rot, and fall to the ground, is often so great as to necessitate the adoption of drastic methods for their extermination.

For some years past, considerable damage has been done in Sicily and Italy by the ravages of a species of bark-lice known as the Mealy-bug. It belongs to the sub-family *Coccina*, and it propagates its species with such rapidity that the leaves of the infested trees are rapidly covered with a dirty, white flocculent matter in which the eggs are laid and hatched. The fruit of the trees, that are so attacked, never come to maturity.

Another mite that is equally dreaded, and which is exceedingly common in Sicily, is the orange louse *Capnodium citri*.

Its presence may be known by the peculiar white substance with which it encrusts the leaves, and by the black fungus which grows wherever the adult ejects the honeydew that it secretes. It is this black fungoid growth that gives the sooty appearance to the leaves, which is so characteristic of this disease. They are exceedingly destructive in their habits; and no kind of fruit is free from their attacks. Their fecundity is enormous, it being estimated that every female produces from 200 to 500 young; and the young mature, and produce a new brood in about three months.

In the Malta and Sicilian orange, the smut fungus often extends to the fruit itself and makes a brownish ring on the outer skin, which gives to the orange the appearance of a russet apple. This is, however, not to be confounded with the disease which is caused by the rust mite.

The rusty appearance, that many oranges have, especially those from Sicily, is due to the presence of minute parasites *(Typhlodromus oleivorus)* which embed themselves in the epithelial cells of the outer rind of the fruit, in such numbers, as to impart to it a rusty, brownish colour. This disease is very common all round the Mediterranean. It neither affects the growth nor the quality of the fruit to any appreciable extent; yet the unsightly appearance that it causes the oranges to present, lowers their commercial value in the market.

Of the scale insects, the most dreaded both in the orange groves of the Mediterranean, and the coffee plantations of Arabia is the mealy-bug. *Dactylopius destructor* was the chief cause of the ravages in the orange groves in Italy, and Southern France in 1806, (L'Abbe Loquez): and from the records that have since been kept, it is to be held accountable for much of the mischief that is now being done.

It usually deposits its eggs on the under side of the leaf, from whence the young larvae spread in all directions, soon after they are hatched.

The smut fungus is an invariable sign of its presence.

Dactylopius Adonidum. Lin. is another species that is equally as common, and as destructive as *D. destructor*. In 1882-1883 it committed much havoc both in Italy and in Morocco.

Among the most efficacious of the precautionary measures that are recommended for the extermination, or the prevention of the spread of this insect, are the thinning of the branches of the trees, and the regular washing of the trunk and branches with emulsions made soap and water, of kerosene highly diluted with water, or with sour milk and water.

Plenty of light is a *sine qua non*, and cleanliness must be punctiliously observed. The free use of powdered sulphur is also an effective remedy. The best way to apply it being to mix the sulphur in water, and spray the trees with the mixture. The sulphur causes the scales to relinquish their hold and fall to the ground, where they may be at once destroyed.

For some years part much damage has been done in the Malta fruit gardens by insect pests; and so general was the distress of the gardeners in 1888, that a commission was appointed by the late Governor to enquire into the causes, and to suggest remedies for the evil.

The Committee under the presidency of Major General Hales Wilkie entered into correspondence with several notable entomologists, among whom were Miss Omerod, Prof. Targioni Fozzetti, Prof. C. Emery, and Prof. Penziz, and from them much valuable information was elicited.

It was discovered that the diseased trees were infested with the scale insect *Coccus hesperidum*; and that it was to this insect that the splitting and falling of the fruit was largely due.

The following mode of treatment for its extermination was recommended by the Malta Commission.

If necessary the trees should be pruned. The foliage should then be syringed from beneath with the an emulsion, in order that the under portions of the leaves should be well washed. To make the emulsion take four pounds of soft soap, and a quart of parafine oil. Mix the soap with a gallon of hot water until it is of the consistency of treacle, after which add the oil slowly, and mix rapidly.

Dilute this with nine gallons of warm water; and keep it thoroughly mixed while using.

After the mixture has been on the trees for two days, the leaves should be well syringed with clean water, so as to remove the soap and the dead insects.

Some times this process has to be repeated; but usually one operation is sufficient.

But extensive as is the mischief wrought by its attacks, they are not to be compared with those for which the orange fly, "Trypeta" *Ceratidus citriperda*, is to be held responsible. For many years past it has been devastating the fruit gardens of the Mediterranean region, and it was chiefly to its destructive propensities that the fruit famine of 1888 was due.

This season (1891) the pears, apricots, and figs are alike more or less effected by it, and so numerous do the insects appear to be, that it is hardly to be expected that the orange groves of the islands will escape entirely free.

It is when the fruit is arriving at maturity that the fly makes its first appearance.

It then punctures the fruit, and lays its eggs within it, and in the course of eight or ten days a large, white, fleshy grub, without legs, and having two small black hooks at the front of the body, which it alternately protrudes and retracts, is developed. The functions of these hooks are to tear the membranes of the fruit, in order that it may obtain access to the contained juices. Its presence in the fruit may usually be detected by the ring of discolouration that surrounds the punctured hole.

It does not confine its attention to any fruit in particular, but it attacks alike the pear, peach, pomegranate, nectarine, apricot, and prickly pear. The fruit in which the larvæ develope usually fall to the ground and while there the grub eats its way out, and undergoes its metamorphosis on the ground beneath the tree. The following description of the full grown fly will enable the observer to instantly recognise it. "It is half the size of the common fly. The wings are transparent, with about sixteen very small black spots at the base and margins, and four dark yellowish dots, having different directions. Its feet are yellow; and the male has two clubbed atennae.

Its abdomen is yellow beneath; and its thorax is black, smooth, and shiny.

It is very active, and is very tenacious of life, being able to endure 12 days of fasting. It is fond of sugary aliments.

The male is somewhat larger that the female. The whole period of metamorphasis occupies about sixty days." (*Gulia.*)

Many suggestions were made for the extermination of this scourge; but all of them entailed considerable trouble and expense.

Among the plans suggested was that of collecting all fallen fruit before the maggots had time to come forth and bury themselves in the soil, and placing it in tanks of water, where a mash might be made that afterwards might be utilized as manure.

The spraying of the trees with a weak solution of petroleum and water; and wrapping each fruit in a muslin bag were also found to be efficacious.

Such are a few of the more common pests that infest the fruit of these regions. Stastistics, however, show that the Mediterranean area does not stand alone. Cape Colony, Florida, India all are alike troubled in this respect, and all suffer in a greater or a lesser degree from the same causes.

Of late years considerable interest has been evinced in the matter, and committees of investigation have been appointed in different parts of the globe for the purpose of devising some means whereby the evil effects of insect ravages may be minimised as much as possible.

Most of these investigations have been carried out on a strictly scientific basis, and they have not only been the means of enabling us to increase our knowledge of the extent of the insect-world' but they have also given us an opportunity of obtaining an insight into the life histories of insects in general, and of that of insect pests in particular.

This systematic study of insect habits and characteristics has shown more clearly than any other branck of Zoology, the exact relations in which insects and plants stand to one another; and it has enabled us to appreciate the more fully that theory of "adaptation of insects to plants, and of plants to insects, and the mutual dependence of the one upon the other", which the great master-mind of Darwin conceived and propounded upwards of a quarter of a century ago.

J. H. Cooke.

A Coral Island on the Great BarrierReef. *

We left Sandy Cape, a Northern point of Trazeos Island about 8.30. a. m. and steamed away to Lady Eliot Island. I can't give you the exact position of the Island, but it lies, I think, east of Gladstone on the Queensland Coast, and is at the S. E. corner of the Great Barrier Reef. The Light-house is first seen; this comes into view from the deck of the steamer at a distance of about 11 miles, and 13 from the bridge. When you can first really see the Island it looks like a long, low, black bank against the sky, with the Lighthouse standing isolated in the centre. Is the black mass all coral, I asked? "No, those are trees." Trees on a Coral Island! Here was the first blow to my preconceived notions of what a coral Island ought to be. A few graceful palms I did not mind, but clumps of trees! Nearer still a stretch of what looked like light, brown sand, (but it was coral.) Then a low white bank. I lost sight of the Island for a moment as the steamer turned, and when I saw it again, being now quite close, it burst upon me with a thrill of surprise. A long, low bank of white coral; absolutely white it looked; white as the coral of one's dreams, white as driven snow against the deep blue colour of the water. This is all that can be seen, a shelving bank of white coral, isolated masses of trees, the lighthouse, and two small woodenhouses. I should judge that the Island is about threequarters of a mile long, and half a mile broad. We all got into a boat and went ashore. White masses of coral gleam through the clear water which is of the loveliest colors, in patches of brilliant, emerald green and sapphire blue. On landing you think how different this is from the coral atoll one has so often read of, the ring of white, set in a blue ocean, the few graceful palm trees raising their heads heaven-wards, and within, the pale green waters of the Lagoon. The beach here is made up of broken pieces of coral of every size, shape, and form, and in every state of wear, from fresh pieces recently detached from the living coral, to pieces worn so thin that they look like artificially smoothed marble.

When you mount this bank which has a maximum height of twelve feet above the sea level, you see neither Lagoon, nor bare expanse of white coral rock, but an exceedingly level stretch of grass-grown land. Here and there, in patches, are bare spaces of grey coral conglomerate, grey as any ancient limestone of carboniferous times and evidently founded upon the parent reef, for pieces of coral rock of all shapes and sizes, together with imbedded shells are plainly to be seen. The grass consists of conch grass, Kangaroo grass (which was planted here by the lighthouse keepers wife) and one on two other kinds. One on two small plants as wild Carrot, sour grass, and others some with small succulent leaves, but none of any size. Two trees appear to flourish on the Island; the Pandauns (or Bread fruit tree as it is commonly called here, though it is not the true bread fruit), the other, whose name I do not at present know, grows in close clusters. The tops of the trees are shorn smooth in a regular curve, ascending gradually from the ocean side of the Island. The leaves are large and green, sub-rotund in shape with entire margins, venation reticulate on the pennate type. The wood when dry is very friable, crumbling to the touch. A third tree has been planted there and seems to do well; its leaves are said to be peculiarly fattening to goats. Of land fauna there is little except grasshoppers, which are a

* *Extract from a letter from Miss J. E. Taylor Maryborough, Queensland to, T. Mellard Reade. Esqr. Liverpool.*

perfect pest. Goats and sheep, are both reared here but there are, at present, too few people on the Island to eat them, so they live in peace.

Round the greater part of the Island there is, at the top of the gradually sloping band of coral fragments I have already mentioned, a second ridge which the Lighthouse Keeper's wife told me had been thrown up almost entirely during the last, great gale. Below this sloping bank of broken coral to about a distance of a quarter of a mile to lowtide level, grows a great variety of small branched corals, the average size being about as big as a large cabbage. There are also many kinds of small stone coral, like what I think I have heard people call "brain stone" coral. All these corals do not grow together into a solid continuous mass, but like a forest of trees, here thickly, there more sparsely. Many strange sea-beasts are to be seen here, the Bêche de Mèr looking like a great black, slimy, animated sausage. A great, green repulsive looking slug, like a gigantic, green, frilled snail. Large blue star fishes, giant clams with their exquisitely tinted shells, which it is said, snap-shut with sufficient force to take your foot off; but I dont know if this is so. I did not try. Echini armed with their numerous spines lie snugly ensconced in cosy nooks.

But the colours of the coral itself were disappointing. There were none of the vivid pinks and greens in these shallow water corals that one hears such wonderful descriptions of. Beyond the area of shallow water is a long line of breakers showing the outer limit of the reef, and beyond it again are the deep blue waters of the Pacific Ocean. Well, these are my impressions of the Island, it was a delightful experience, and one I am glad to have had. I shall go again if I get the chance. You could make a lovely collection of things if you were there long enough.

CYPRUS,

by Lieut.-General Sir R. Biddulph, G.C.M.G., C.B., late H. M. High Commissioner, Cyprus.

(Continued.)

The total cost of the locust destruction from 1879 to 1885, was 66,000*l*; but as the loss to the crops in a single year, had no steps been taken to destroy them, would have been not less than 80,000*l*., the outlay has been recouped many times over. The manner in which locusts destroy green vegetation is perfectly appalling. With marvellous rapidity, and regardless of any interruption, they strip off every green thing, and in a few hours the green fields which they attack disappear, leaving a few brown stalks issuing from what appears to be a fallow field.

The Cyprus locust lays its eggs in hard rocky ground. Each female deposits a cocoon, which contains usually, thirty-two eggs. The female bores a hole in the ground to nearly the depth of her own body, and there deposits the cocoon, which she then covers over with earth. Attempts were made at first to destroy the locusts by collecting the eggs, but though as much as 1300 tons weight were collected in one year, it was found to be a useless expense, and that the screen system could not be dispensed with.

The prevalence of locusts in Cyprus is noted in an old chronicle of the thirteenth century, but it is only since the forests were destroyed that they have made head in the manner which has been so notable in modern times. It is not likely that the great breeding grounds of the locusts will ever again be clothed with forest; and we must look for the disappearance of the locust when the population increases, and with it the cultivation.

The population of Cyprus at the census of 1881 was 186,000, of whom one-quarter are Mahometans, and the remainder of the Greek Church. It is said that under the Venetians the population was 2,000,000, but it is believed that it did not exceed half that number. An English traveller who visited Cyprus in 1815, states that the population then was between 60,000 and 70,000, and the produce of the Island was then so small that the population must have been very scanty.

The people are almost wholly agricultural, the principal products being wheat, barley, cotton, carobs, olives, and grapes. From the latter is made an excellent wine, which has been famous from the earliest ages. It was the excellence of the wine which led to the Ottoman conquest of Cyprus by Selim II. That monarch, being very found of wine, sent an expedition, in 1570, to take the island. The agricultural operations are

carried on in a most primitive manner, and the wine is manufactured in the rudest way, the bunches of grapes being squeezed under planks, and obtaining a rough acrid taste from the stalks and grape-stones which are squeezed with them. The amount of wine made every year in Cyprus is about 1,600,000 gallons, of which about four-fifths is exported, chiefly to France, Egypt, and Turkey.

The agricultural prosperity of Cyprus is a matter of the gravest interest to the Government, for on that prosperity the revenue entirely depends. There are hardly any large properties in Cyprus, and still fewer instances of land worked on the tenant former system. It is emphatically a land of peasant proprietors, with the result that there are no wealthy persons and no beggars. Property is universally divided amongst the children, and again subdivided, so that one hears of a man owning the sixteenth part of a hovel that is not worth as many shillings. To such an extent is the subdivision carried out, that there are no less than 600,000 registered holdings of real property, i. e. more than three for each inhabitant. On each holding there is a land-tax of of four per 1000 of its registered value, and the collection of such small sums from so many owners causes much labour and difficulty. The chief tax on land is, however, the tithe, which is, under Turkish law, the actual tenth part of the produce. It is not quite right to speak of it as a tax, it is really a reserved rent. In Mahometan countries all the land belongs to the State, i. e. the Crown. As each country was conquered the Sultan granted the lands, reserving one-tenth of the produce as rent, and the land passes subject to that reservation. Nor can it be said to be an excessive rent. In India we find one-sixth, one-fourth, and even one-third reserved. Joseph reserved one-fifth in the land of Egypt. In England the landlord is supposed to get one-third, leaving two-thirds for the tenant occupier.

At might be expected, in a country which is almost wholly occupied by peasants, the houses are poor, and exhibit little architectural skill or beauty. They are mostly built of sun-dried bricks; the villages usually contain from twenty to eighty houses, and there are but few considerable towns. The principal of these are: the capital, Nicosia, situated in the centre of the island, and having 12,000 inhabitants; Larnaca, the chief seaport, with about 7000 inhabitants; and Limassol, also on the south coast, with about 6000 inhabitants These two ports divide between them nearly the whole of the sea-borne trade, Larnaca taking nearly half the exports and three-quarters of the imports, and Limassol the rest of the imports and about half the exports. There is also a small export trade from the ports of Famagusta, Papho, and Lefka, and a moderate trade at Kyrenia, chiefly carried on with the opposite coast of Karamania. To facilitate trade good iron piers have been built at Larnaca and Limassol; and a break water at Kyrenia, where the small country vessels suffered much in winter from northerly gales.

The town of Nicosia presents a pleasing and picturesque appearance to the traveller approaching it from the south. It lies compactly situated within a line of old fortification, which describe a regular circle round the town. As there is no suburb outside the wall, the ramparts neatly finish off the houses, whose roofs appear above them in in pleasing irregularity. The area enclosed by the fortifications is less than a square mile, but at least half of it is occupied by gardens, as nearly every house has a garden attached to it; and viewed from the heights above, the houses are are mixed with palm-trees, and orange-trees, the latter in great abundance, and scenting the air of the streets quite heavily when in blossom.

Rising above all the surrounding buildings is the old Latin cathedral, now a mosque, with two handsome minarets built on to it. This is kept in very good repair, and underneath the carpets which cover the floor may be seen the old grave-stones with the names and effigies of knights and ladies with Latin or old French inscriptions.

Before the Turkish conquest in 1570, Nicosia occupied a much larger area than it does at present; but in anticipation of the Turkish attack, and probably in order to facilitate the defence, the old fortifications were thrown down, and the present ramparts constructed to enclose a much smaller area. All the houses outside the new line of defences were destroyed, and the old ramparts may still be easily traced although they are annually ploughed over.

The point where the Turks attacked was marked for future ages by the erection of a mosque on the breach. There it stands to this day, being called the "Standard-bearer's Msoque." It marks the spot where the leader of the Turkish storming party planted the flag of the Crescent on the very summit of the breach, and there he fell. The Moslems, however, pressed forward and drove the Venetians backwards into the town. The defence of the latter must have been most gallant as they fell bek on the Governor's palace. The track of the conquerors may be traced to this day by the tombs of their leaders who fell during their advance, and, according to Turkish custom, were subsequently buried where they fell. The Standard-bearer was buried on the summit of the breach where the mosque now stands. At intervals along the streets leading to the old palace, now the "Konak" or Government Office, are the tombs of others of the Turkish leaders, and when we get to the Konak they are numerous. In the gateway itself is one, just outside is another, others in the courtyard and in the garden, and some upstairs in the rooms. You open a door of one of the offices, and in the corner is a tomb covered with a green flag. All the tombs are similarly cared for, and it strikes me as a fine soldierly trait of the Turkish character thus to hand down in perpetual remembrance the fame of the soldiers who achieved the Ottoman conquests, by the silent witness of their tombs on the spots where they fell. At the time of the British occupation, everything seemed to to have been left untouched since the arrival of the Turks. On the ramparts there were the Venetian guns—large bronze pieces, each profusely ornamented and engraved with the name of the founder and the badges of the Republic; the carriages quite unserviceable from the effect of time; the shot, round and barshot, neatly piled up by the side of each gun; the magazines filled with powder, and over the door of the principal one, the armoured headpiece of a horse, such as you may see in the Tower of London—the last relic in Cyprus of the Venetian Knights.

(To be continued.)

Notes on the Lepidoptera of Malta.

Entomological studies, and I may venture to say all researches regarding the entomofauna of these islands, have been so completely neglected that even the favourite study of the Lepidoptera has been everlooked to such an extent that a complete and exact catalogue of the few species that are to be found in the islands, has not yet been published.

This might be attributed to the small number of local species, and to their little importance, which, with few exceptions, have neither led collectors to care for them, nor naturalists to apply themselves to this particular study.

But though the species are neither rare nor peculiar to these islands, it does not therefore follow that they are undeserving of attention.

They should be known and recorded if it be but for the purpose of rendering the knowledge of our entomological fauna more complete.

In the course of my botanical rambles in various localities of the island at different seasons of the year I made a point of collecting the butterflies that I met with, putting them carefully away for after study. I must gratefully acknowledge the very valuable assistance that was accorded me in my work by my esteemed friend Mr. R. Briffa P.A.A., who not only assisted me in collecting the specimens, but who also lent me his aid by comparing my notes as to locality and time with those of his own. To Mr. Ragusa and Dr. Riggio I am also indebted for the great courtesy shown to me, and for the determination and explanation of some of the species, many of which they compared with others both in the Museum of Palermo, and in their own collections.

To the celebrated lepidopterists Dr. Staudinger and to Dr. Failla Tedaldi I am also indebted for like services, and I now beg to offer them my sincere thanks. To ascertain what had previously been done, in order that I might know what to add to our present knowledge and what to modify, I had to make a bibliographical research. I referred to the collections that had already been made by those who had interested themselves in the study but so few were they, that with the exception of the collections of Mr. Briffa which contain numerous selected and well kept examples, that of

M. Caruana Gatto, my uncle, and that of my own, I was, I am sorry to say, unable to find any other in the island.

Father Libassi had one which up to some time ago could be seen at the University of Valletta, but having been badly kept and neglected it was quite useless, "There remaining nothing in it" as Mr. Fraser observed in a letter written to "Nature" in 1889 "but an empty box". The late Prof. Gulia also had one, which he utilized for his "Corso di Entomologia", but it appears that it is now no longer in existence.

The oldest lists of Maltese insects extant is a manuscript one which was drawn up by Dr. Schembri the late Rector of Valletta University. For many years it lay in the library of the institution unknown to any one, until through the kindness of Prof. N. Tagliaferro it was brought to my notice and used by me. It is, however, nothing but a mere enumeration of the species that were contained in the collection of Father Libassi; and in it there are 13 Rapoloceri, five of which I do not think were taken in Malta, and this, because there are several other examples in the same collection, that are certainly foreign to the island. These five species are *Pieris napi*, *P. crotaegi*, *Satyrus bathseba*, *Arginnis adippe* and *Colias hyale*.

The other species are:—*Papilio machaon*, *Vanessa atalanta*, *V. Cardui*, *Pieris brassicæ*, *Satyrus janira*, *S. maegera*, *Rhodocera rhamni*.

In a series of letters writting by Mr. George Waring under the title of "Letters of a naturalist from Malta and Sicily" and published in 1843 there is a brief reference to the *Colias edusa*, to *Papilio machaon* and to the *Pieris brassicæ* which were found here. W. Tallack in his book "Malta under the Phœnicians, Knights, and English" 1861 adds *P. Daplidice*, *C. hyale*, *Pol. agestis* and *H. Janira*.

The first book which treated exclusively of Maltese insects was the "Corso elementare di Entomologia maltese" which was published in 1858 by Prof. G. Gulia; but the elementary character of the work, and the abundance of uncertain facts and undetermined species take away a great deal of the value that it would otherwise have had. Referring to the butterflies, Prof. Gulia enumerates the following 12 species:—*P. brassicæ* et. var. *crucivora*, *P. napi*, *Rhodocera rhamni*, *R. cleopatra*, *V. atalanta*, *Ochsenhumeria cardui*, *P. machaon*, *P. podalirius*, *E. edusa*, *C. lesbia*, *Polyam. phleas*, *P. argus*.

Of these *P. podalirius*, *P. napi*, *C. lesbia*, *Pol. argus* and the var, *crucivora* of *P. brassicæ* have no right to be figured among the Maltese species; and consequently in his "Repertorio di Storia Naturale" which was kindly lent to me by Dr. Gulia I find that under the heading *Farfett* (the Maltese word for butterflies in general) he has left out the last three species, and added instead *H. janira*, *H. maegera*, *C. pamphilus*, and *P. daplidice* which were at first omitted.

Of this "Repertorio" but very few copies were originally printed, and the work is, therefore, now a very rare one.

The Rev. G. Godwin in his little volume "The Geology, Botany, and Natural History of the Maltese Islands, 1882" refers to the above mentioned entomological course, but without nothing either the corrections or the addenda.

More recently still, Mr. Fraser inserted a short note "Maltese butterflies" in "Nature" January 2nd. 1890, wherein he mentions 6 or 8 species by their English names, and notes the smaller proportions of the Maltese species when compared with the same species on the Continent; and among others that he says he observed flying about in the garden of his hotel at Sliema were the "Tortoise shells" under which name are included *Vanessa urticae*, and the *V. polycroos*. I am, however, inclined to think that he must have mistaken these for *V. cardui*, and the *V. atalanta* which are often so changed in appearance by exposure to wind and rain as to make them at first sight appear to belong to other species; for there can be no doubt but that neither *V. urticae* nor *V. polycroos* exist in the islands much less are they to be found in abundance, as Mr. Fraser asserts.

Kirby in his "European Butterflies", too, assigns Malta as being an *habitat* of *C. hyale*, and *C. edusa*, and he states that they make their first appearance in February. For my part I am more inclined to the opinion expressed by Dr. Staudinger, that the faded variety of the female *C. edusa*, must have been mistaken for *C. hyale*.

The following catalogue comprises the species which were observed and collected by me.

RHOPALOCERA

Papilionidae

Gen. Papilio L.

1. Machaon L. v. sphyrus Hb:—Maltese *Farfett-tal-feigel*, St. Macaone, Eng. Swallow Tail.

Frequent in gardens from March to November, but especially so during the months of April and September, Caterpillars are to be found in August and September for the most part on the rue. Chrysalles of the last hibernate. Like the Machaon of Sicily, the Malta species belongs to the var. *sphyrus* from which I do not see any other difference except that the marginal "lunules" of the upper wings are seldom ferruginous. Even Mr. Ragusa to whom I have shown our species, considers it as belonging to the Sicilian variety. Mr. Fraser expresses the exact facts of the case when he asserts that the individuals of our species do not generally attain the normal dimensions of the typical form.

Pieridae

Gen. Pieris Schrk.

2. Brassicae L.—Maltese *Farfett tal cromb*. It. *Grande cavolaia*, Eng. *Large cabbage white*. Very common in all parts of the islands and at all seasons, but especially so between February and March. Caterpillars infest the cabbage fields, and often cause great loss to the country-people, who, before cutting the plants, examine them several times one by one, and take away the insects and kill them.

3. Rapae L. ef var minor Costa:—Maltese *Farfett tal cromb zghair*, Italian *Rapaiuola* Eng. *Small cabbage white*.

Very abundant like the preceding, and at the same season. The black spots on the wings vary in size, and like the "minor" form is generally to be found in summer

3. Daplidice L.—Eng. Bath white.

From March to November, it is to be found though not frequently in uncultivated places as at Fort Manoel, Corradino etc.

Gen. Colias. F.

5. Edusa L.—Malt. *Zolfina*, Eng. *Clouded yellow*. Common in fields, grassy places and valleys during all seasons but especially so in Autumn. It is rare from December to February. Kirby fixes its appearance here in March; but it is also to be found in February, and sometimes during the fine days of January (Briffa!).

The colours of the females of this species are often very pale; and it was this that probably led others to take it for the *C. hyale*.

Gen. Rhodocera. B.

6. Rhamni B.—Malt. *Farfett tal ziu*, It. *Cedronella*, Eng. *Brimsone Butterfly*.

Prof. Gulia says that this species is common in gardens together with *R. cleopatra*; on the contrary it is very rare, and I have only seen it in the collection of Mr. Briffa who took it in Spring time in the Hasting's garden in Valletta, and he saw another flying over the terrare on the 16th of March, and on the same day another of the same species was seen near Pembroke Camp by Mr. Phillip de la Garde.

7. Cleopatra L.

Less rare than the preceding, but yet not common, and limited for the most part to the gardens and valleys af the western side of the Islands Mr. Briffa collected it at Gneina and Imtahleb and Prof. F. Debono also showed me a specimen which had been taken in the Botanic Gardens in June.

Lycaenidae

Gen. Polyammatus Latr.

8. Phleas L.—It. *Polyammato Xante*, Eng. *Common Copper*.

Common in gardens, valleys, and grassy plains: localities, Boschetto, Uied Encita, Corradino ets.

Var. Eleus F.—It is the form of a deeper colour which predominates in the Summer.

Gen. Lycaena F.

9. Baetica L.—Malt. *Farfett ikhal*, It. *Azzurrina*.

Frequently found in gardens and valleys in the summer time, especially upon *Duranta plumerii* and upon *Phaseolus caracalla* e. g. St. Antonio's Gardens, The Botanical Garden, Boschetto etc.

10. *Astrarche Bgstr*:—It. *Argo bruno*. Eng. *Brown argus* Common in the Spring and Summer on the plains and in the gardens and valleys. e. g. Boschetto, Emtahleb, Uied el Ghasel etc.

11. Icarus Roth:—Malt. *Farfett ikhal*, It. *Azzurrina*, Eng. *Common Blue*.

Of the same frequency, and found in the same places as the preceding from March to November, e. g. Marsa, Corradino etc.

For the determination of this species which has hitherto been confounded with the Argus I am indebted to Dr. Riggio, who also showed the examples that I sent to him, to Dr. Failla.

The wings vary in the width of the white margins; and in the spots which are more or less distinct.

ALFRED CARUANA GATTO.

(to be continued).

The Salt Mountain of Palestine.

At the south end of the Dead Sea a salt mountain has been naturally formed, which attains a height of nearly 600 feet above the level of the sea, and which is about six miles long, and three-quarters of a mile broad.

It runs along the shore line in some places extending to the very water's edge. It is situated at the opposite end to that into which the Jordan discharges its waters; and the waters in its vicinity are therefore much salter than are those at the northern extremity.

How far the salts extend underground is not yet known; neither have we any means of ascertaining its age, but Dr. S. Merrill states that in some places it is covered with overlying earthy deposits of evident antiquity, and of great thickness.

The government adds very considerably to its revenue by causing the salt to be worked under their immediate supervision, and by retaining the exclusive right to the trade that is carried on with this commodity in different parts of Palestine. Dr. Merril tells us in a letter to the "Scientific American" that if Arabs, or the natives of the country were found getting salt from the Dead Sea, or from this mountain, that they would be at once arrested. The working of these salt deposits for foreign export would be the means of considerably increasing the prosperity of the country, but, unfortunately, at present the Turkish government will not sanction any project of the kind.

Observations on the Geology of the Maltese Islands.

BY

JOHN H. COOKE.

(continued).

When we take into consideration the nature of the numerous and varied changes that the islands have undergone, it would be surprising indeed were not some evidences forthcoming to enable one to judge of the origin of the causes that had given rise to them.

The area has been successively, the bed of an ocean, a part of a continent, an extensive island, and now, in its latest phase, we see it as a group of islets situated in the middle of a great land-locked sea.

Nor has the history of its inhabitants been of a less varied nature. It is still a moot point as to whether the evidences, that are forthcoming, are sufficient to justify us in admitting that man was present in Malta during the Pleistocene age. Those that have been adduced, so far, are of a very fragmentary and inconclusive nature; (1) though it would seem that careful research may result in the obtaining of more definite information on the subject.

Nor so, however, are the evidences of the occupation of the islands by the forms of the brute, and of the vegetable creation during that period.

The osseous breccias that clothe the southern slopes of the islands, and the contents of the numerous caves and fissures, afford evidences that prove that Malta was formerly the centre of an extensive and well watered country, on the banks of whose rivers and valleys there existed a flora and a fauna, that, at least, equalled that which now luxuriates in the basins of the Amazon and the La Platte.

When the connection between Europe and Africa existed by way of Malta, a luxuriant vegetation clothed the intermediate area, and an opportunity was thus afforded to those types of the animal and vegetable kingdom, that then existed in the southern parts of Europe and the northern parts of Africa, to migrate from the one locality to the other, and to thoroughly establish themselves. It was the great analogy, that was found to exist between the flora and the fauna of the two shores, that led Heer, the Swiss savant, to consider, not only that such a connection had formerly existed, but also that it had prevailed for a considerable length of time.

In Algeria, Morocco and Tunis as in Spain and Portugal, large numbers of plants grow that are identical; while of the 3000 plants that have been

(1) *Davy. "Observations on Malta," vol. I. p. III.*

found in Algeria, upwards of eightly per cent are to be found flourishing in Corsica, Sardinia, Sicily and along the southern shores of Europe even as far east as the Grecian Islands.

The lentisk, arbutus, myrtle, cistus, tree heath, and many others that are found in Algeria, are identical with those that grow in Corsica and Sardinia; while the dwarf palm *(Chamaerops humilis)* grows spontaneouly alike in Corsica, Sardinia, Algeria, Tunis, Sicily and in the islands of the Levant. The tailed bactrachians, that are found in these countries, is also another remarkable evidence of this continuity of the Mediterranean fauna.

Prof. Gervais, (1) points out the similarity between the genera and species of the living insectivora in the north of Africa, and those in the south of Europe; and Dawson (2) observes that the porcupine of Algeria presents no distinctive characters of sufficient importance to justify it being considered of a different species to the European one.

The inferences to be drawn from the above facts have been corroborated by the work of the Admiralty Survey in the Mediterranean.

Between Sicily and Malta there are two banks the Aventure bank on the west, and the bank on the east, the elevation of both which to a height of but 40 fathoms would again create a passage of dry land between the two islands.

Between Malta and the African mainland the soundings showed a depth of 344 fathoms.

Supposing, therefore, that the sea bed should be elevated 400 fathoms, a broad isthmus would again connect the continents, and Malta would from a part of the centre of it.

That such an elevation of the Mediterranean region has occurred in time past is shown by the remnants of moraines, and other evidences of of glacier action that are now to be seen in the mountains of Lebanon, of Anatolia, (3) and of the Atlas mountains.

When glaciers and snow fields existed in these districts, the whole area of the Mediterranean must have been situated at a much greater elevation that now; at an elevation, in fact, such as would have raised the bed of the Mediterranean and have made a land passage both between Gibraltar and Morocco, and between Italy and Tripoli (1). In accounting for these and other phenomena of a similar nature Dawson computes the elevation to have been between 6000 and 7000 ft. while Profs. Ramsay and Geikie consider an upheaval of from 1500 to 2000 feet to have been sufficient to have effected the same results (2).

Nor are the paleontological evidences that are afforded, less conclusive. That Malta was inhabited, and that free communication once existed between Europe and Africa by way of Malta, are proved by the mammalian, and other remains that have been discovered in Malta, and in the regions that lie on either side of it.

The caves of Malta, Sicily and Italy abound with fossil mammals of a purely African type. The remains of *Elephas africanus* have been found in great quantities in the caves of Syracuse, of Palermo, and of San Teodoro; and intermingled with them have also been found two species of African hippopotami. (3). The presence also of the bones and teeth of *Elephas antiquus*, and of *Ursus ferox*, a species of bear whose remains occur in abundance in the Gibraltar caves, in the caves of Provence and Mentone, as well as in the caves of Sicily, afford evidences of this elevation, and point to a connection between Sicily and Europe prior to the formation of the Straits of Messina. The Maltese-Sicilian isthmus that connected the two continents, afforded the means of migration to animals and plants alike. And as the remains of animals of a distinctly African type are at the present day to be found in Europe, so also are the remains of animals of a distinctly European type to be found in Africa. M. Bayle described an interesting stratum of clay that he found at Mansourah in Algeria, and with the assistance of Prof. Gervais it was demonstrated that the remains that were found in it, contained among others, the molars

(1) *Gervais, "Animaux Vertébrés Vivants et Fossiles." p. 48.*

(2) *Dawson, "Cave Hunting" p. 380.*

(3) *Nature, vol. V, p. 444; vol. 6, p. 536.*

(1) *Dawson W., "Cave Hunting", p. 380.*

(2) *Ramsey A. C. and J. Geikie on "The Geology of Gibraltar". Quart. Journ. Geol. Soc., vol. XXXIV, p. p. 537, 531.*

(3) *Falconer. "Paleontological memoirs" v. II p. 543.*

and bones of an elephant, *E. meridionalis*, which in the pleistocene age had its headquarters in Northern Italy, but which had roamed as far south as Northern Africa by means of this land connection, via Malta. (1)

To this mass of evidence the Pleistocene Beds of Malta, have likewise furnished their quota of proofs.

The river detritus, and conglomerate that are to be found in the caves and fissures of the islands abound with the remains of at least three distinct species of elephants, with those of a hippopotamus, of a giant swan, of a giant dormouse, and of other animals. Of the elephants, two were of a species that attained a size that barely exceeded that of a Newfoundland dog. Both have laso been found ni abundance in a fossil state in the caves near Palermo by Baron Anca; and their molars were pronounced by Dr. Falconer to be identical with those of *E. africanus*.

In the Malak and the Mellaha caverns of Malta Dr. L. Adams found also the bones and molars of pigmy hippopotami. *H. pentlandi*, the geographical range of which has been shown to have extended all over southern Europe as far east as the Peloponese. In the caves of Palermo its bones were found in such quantities that, a few years ago, they were exported by the ship-load from the country for the purpose of making lamp-black. (2).

The presence of these animals in the Maltese Islands, in northern Africa, and in southern Europe, can only be explained on the supposition that the Maltese Islands once formed a part of a land mass of considerable area: and that, that land mass must have been in direct communication both with Europe and Africa.

Of the climate, and other physical conditions of this epoch, we know but little. The opinions that are held by geologists, are conflicting; and considerable difficulty is therefore experienced when attempting to draw definite conclusions from the facts that have, up to the present, been collected, and from the arguments that they have adduced in explanation of them. Some of the facts, however, speak for themselves, and if carefully considered, they enable us to obtain an approximate idea of the nature of the conditions that prevailed in past ages.

Let us wander forth into the wilds of primaeval Malta, and judge for ourselves of the mutations that occurred during the enormous tracts of time, that have intervened between this and then.

(To be continued.)

(1) *"Bull Soc Geol. Fr." 2 ser., t. XI., p. 304.*

(2) *For a detailed account of the specific characters of these extinct animals see Adam's work, and Falconers "Paleontological Memoirs.*

Science Gossip.

The current number of "Nature Notes", the Selbornian magazine contains an interesting and practical article on "Home Museums" which is well worthy of attention.

The principal electric lamp, that is being used at the London Naval Exhibition, was made by an Italian, Sig Amirante. It gives a light, the intensity of which is equal to that of five million candles.

A most interesting series of articles on the "Persistence of the cranial form in the province of Aquila, from Neolithic to Modern times" are now appearing in the current issues of "La Rivista Italiana di Scienze Naturali."

Messrs Sampson Low & Marston have just published the work entitled "The South Italian Volcanoes" by Dr. Johnston-Lavis, M.D., M.R.C.S., &c. which was announced in our columns two months ago. We hope, in a future number, to be able to give our readers a short resume of its chief features.

The influence of food upon the rate of formation of carbonic acid says the "Scientific American" has been made a matter of special study in France; and it has been found out that during the first hour after a meal, the quantity of CO_2 exhaled increases till it reaches a maximum three or four hours after the meal, when it falls off again.

Plenty of fresh air is desirable from one to three hours after a meal.

In an essay on "Dragon-flies v. Mosquitoes'- which gained the first prize in an open competi tion for the best methods of destroying the mos-

quito and the house-fly, Mrs. C. B. Aaron brings forward some very serious indictments against these household pests.

Not only do they assist materially in the dissemination of Bacteria, and thus serve as efficient propagators of infectious diseases, but she also adds that they act as carriers of such parasites as Filaria, and some species of Toenia. For their extermination she suggests several mechanical and easily applied methods, among which may be noted, the free use of crude petroleum in all damp places, and in all collections of stagnant waters.

The oils floats on the surface and when the larvæ come to the surface to breathe, the oil clogs the breathing tubes and thus suffocates them.

Other methods are discussed such as the rearing of the dragon-fly which is a natural enemy of the mosquito; but this is not recommended owing to the trouble and uncertainly that are entailed.

In the museum of postage stamps at Vienna, says the "Nuova Antologia", there is a collection of 100,000 examples; among the rarest and most valuable of which are the stamps that were used on the dispatches that were sent during the Franco-Prussian war of 1870-1871.

A statistical table, showing the comparative frequency of storms and of lightning in various parts of the world, has been drawn up, and from it we have obtained the following particulars.

In Java, 97 days of the year are stormy; in Sumatra, 86 days; Hindostan, 56 days; Rio de Janeiro, 51 days; Italy, 38 days; Holland, 18 days; France, Austria and Russia, 16 days; Spain, and Portugal, 15 days; Switzerland and Finland, 8 days; England, and Scotland, 7 days; Norway, 4 days; China, 3 days. In Malta the average is 12 days for thunderstorms, and 18 days per year for lightning.

Prof. Duncan, F.R.S. in his interesting work on the "Transformation of Insects" gives the following decription of the life history of that troublesome, but in these regions, very familiar pest, the flea.

Fleas lay their eggs in cracks, in cushions, and in boards, or in the midst of dust, and their larvæ, which have no legs, and which therefore must live where they have been born, can only exist in consequence of the nourishment brought to them by the adults. Were they abandoned, they would perish, but they have excellent mothers who never leave them; for after a flea, should it be a mother, has gorged itself with blood, it seeks its young and disgorges a small quantity, so as to keep them alive. The larvæ shut themselves up in silken cocoons when they have attained their full size, and undergo their metamorphosis into the condition of nymphs.

Among Messrs Sonnenschien's scientific publications during the present Autumn we note the following.

The Colours of Animals. By Prof. REDDARD, of the Zoological Society's Gardens and Guy's Hospital, London. With Coloured and other Plates and Woodcuts.

Man and Mammals. By Dr. OSCAR HERTWIG, Professor of Comparative Anatomy in the University of Berlin. Translated and Edited from the Third German Edition (with the assistance of the Author) by Dr. E. L. MARK, Professor of Anatomy in Harvard University. (Printed in England.) With 389 Illustrations and 2 Coloured Plates.

Invertebrates. By Drs. KORSCHELT and HEIDER, of the University of Berlin. Translated and Edited by Dr. E. L. MARK, Professor of Anatomy in Harvard University. With several hundred Illustrations. (Printed in England.)

Text-Book of Animal Palæontology. By Dr. THOMAS ROBERTS, of the Woodwardian Museum, Cambridge. Designed as a Supplement to Claus and Sedgwick's "Text-Book of Zoology". Illustrated.

Text-Book of Geology. Adapted from the work of Dr. EMANUEL KAYSER, Professor in the University of Marbug, by PHILIP LALE, of St. John's College, Cambridge. With Illustrations.

Text-Book of Zoology. By Dr. C. Claus, of the University of Vienna, and ADAM SEDGWICK, M.A. F.R.S., Fellow and Lecturer of Trinity College, Cambridge and Examiner in Zoology to the University of London. Vol. II.: Mollusca to Man. Third Edition.

The many experiments that have been carried on in the Mediterranean for the purpose of determining the penetrating power of light have been attended with some curious and interesting results.

The methods usually employed have consisted in placing gelatino-bromide photographic plates at different depths under the water; the plates being lowered by a sounding lead, and protected from the action of the sea water by a varnish. Experiments were made about 1,300 to 1,400 meters off the Cape of Mont Boron, at Ville-Franche in the Gulf of Nice, and in water about 550 meters deep. During April the limit of penetration of the daylight about midday, during fine weather, was found to be about 400 meters. Other observations showed that there is a penetration of 300 meters all the time the sun is above the horizon, and of 350 meters during eight hours of the day.

Correspondence.

Our Birds.

Valletta-Malta.

Sir

During my rambles about the islands I have repeatedly had my attention attracted to the great number of so called "sportsmen" that infest the fields and highways for the purpose of shooting the few birds that endeavour to find a home in the valleys. Nothing is sacred to these butchers: they shoot all and every thing that come in their way, though they seem to devote their special attention to the extermination of our robins and sparrows. On Sunday last, while in the vicinity of Maddalena, I met a party of youths from the adjoining casals, seven of whom carried guns. Is it possible that all of these have been granted licences by the authorities? I hardly think so, for at least three of these embryo hunters were but little over 12 years of age.

At a time, when so much distress has been occasioned by the attacks of the orange fly on the fruits of the islands, it surely behoves the authorities to take steps to present such wholesale slaughter of the feathery guardians of our orchards.

Birds are the natural enemies of flies and insects of all kinds, and a decrease in their numbers must necessarily be followed by an increase in the number of insects pests.

Apart, therefore, from all feelings of sentimentalism, the birds should be protected if it be but for the purpose of assisting the agriculturists of the islands; and this might readily be done either by limiting the number of shooting licenses issued, or at least by carring out the existing regulations more stringently, and calling to account all of those who use firearms without the necessary permit.

Yours faithfully

A. Visitor.

Exchange Column.

Notices are inserted in this column free of charge. We request that all exchanges may be signed with name (or initials), and full address at the end.

Wanted:—Wanted to purchase a good Italian dictionary. Address J. W. 10 Strada Ridolfo, Sliema, Malta.

Wanted:—Geological lantern slides in exchange for Maltese lepidoptera & hemiptera. Address. F.W.W.C/o Editor "Mediterranean Naturalist" Malta.

To Curators of Museums:—Specimens of the "Fungus Melitensis"—*Cynomorium coccineum. L.* for exchange or purchase Address F.W.W. C/o Editor of "Mediterranean Naturalist" Malta.

Microscope: —Wanted a first class microscope by Beck, Swift, or Crouch, in exchange for a "Safety" bicycle, value £ 12. Apply J. C. 29 Park Street, Weymouth.

Editor. J. H. Cooke. B.Sc., F.G.S., Malta.

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THE

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CONTENTS.

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Subscriptions are now due.

Special Notice to Readers.

Those of our readers who have not yet sent in their subscriptions are kindly requested to do so at an early opportunity.

To Correspondents.

All communications intended for insertion should be written on one side of the paper only; and should reach the Editor on or before the 12th of the month. Whenever an answer is required through the post, a stamped and directed envelope should be enclosed.

Secretaries of Societies are invited to forward us reports of their proceedings; and Curators of Museums will confer a favour by informing us of any new and important additions that may be made to their collections.

Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

Sketch of the Geology of Pantelleria, importance of its thermal springs to the Maltese.

One hundred and forty miles to the West of Valletta is the little town of Pantelleria, built at the northern extremity of the island of the same name, which constitutes one of the 12 Sicilian volcanoes, and is likewise the largest of the numerous outlying islands belonging to Sicily.

Pantelleria, situated midway between Sicily and Tuñisia, in that part of the Mediterranean known as the African Sea, is exclusively of volcanic origin. The view from the sea on entering the little port is fine and highly picturesque, the town occupying the gently rising ground behind the beach while the cultivated land on the slope of Monte Sant'Elia is pleasantly dotted over with small houses in the midst of vegetation of a southern type. Above all, in the background and flanked by minor eminences, rises the Montagna Grande, the height of which is not so very much less than that of Vesuvius, while the entire mountain mass of the island taken together is far greater, and the general outline to my mind, infinitely more beautiful.

Somewhat elliptical in form, Pantelleria measures 8½ miles in length from N.W. to S.E.; its breadth in the direction of N.E. to S.W. is 4½ miles, and the area 25,423 acres. Towards the south of Pantelleria rises the Montagna Grande, 836 metres (2742 feet) above the level of the Mediterranean, separated by a narrow ravine or valley on its southern slope from the Gibel, the Arabic word for mountain, redundantly called Monte Gibele, 700 metres (2296 ft.) high. Still further south is the Cudda Attalora 560 metres (1837 ft.), while Monte Gelkhamar, to the west of the Montagna Grande, rises to the height of 280 metres (918 ft.), and lastly, Monte Sant'Elia, already alluded to, above the town of Pantelleria, about the same height as the

former one. Long lines of bold precipitous cliffs many hundreds of feet high are prevalent on the south and east sides of the island, clearly marking the considerable wear of the coast line, while at the northern extremity the ground slopes gently towards the sea, and thus we are prepared to find that the depth of water in the lilliputian port is only about two fathoms in mid channel, just sufficient for small coasting and fishing craft to take shelter behind the Eastern point.

This remote corner of Europe is the home of 7178 persons, who are well nigh unknown to the rest of humanity, and who know still less of the world themselves, with the rise and fall of empires, to care to rack their brains with the book learning of their fellow men, or trouble themselves with inquiring into such superfluous matters as steam machinery or electric lighting. Pantelleria town has 3167 souls; the remaining 4148 inhabitants are divided among five scattered groups of country cottages, rather than villages, for as "Judah and Israel dwelt safely, every man under his vine and his fig tree" in the days of King Solomon, (I Kings, chapt. 25), so it literally now is with the Pantellerians under king Humbert, viz:—Khamma 1374; Scauri 1319; Napolicibile 510; Margana 596; Bugeber 349. Administratively all belong to the commune of Pantelleria, which forms part of the province of Trapani.

The tracks used by the Pantellerians have been preserved with the most religious care in the precise condition in which they were long before the glorious days of Carthage, which rose almost in sight of the island; and in jolting along these rough stony places it needs to be lamentably devoid of all the pleasures of inspiration not to have proud visions of the good old times when Mother Earth was some 3000 years younger than she is now, and had been drenched with the life's blood of some billions less of her sons, pitted in mortal strife agains peach other for no purpose but the wanton pleasure of destruction. Descending from these heights, the matter of fact geologist gets easily reconciled to the slight inconveniences of the way, finding a splendid race of large asses to ride upon similar to those of Egypt, as he passes, hammer in hand, through vineyards and plantations of cotton, capers and other vegetation, grown on the rich decomposing volcanic soil, and freely alternating with a variety of lithological forms of eruptive rock, here scoriaceous, further on massive or cellular, in some cases rough to the touch, elsewhere so like the prosaic refuse heaps of some common black bottle works as to require close inspection in order to disillusionize him.

To the best of my knowledge no eruption of this volcano is recorded during historic times, but it is evident that the numerous prehistoric eruptions which took place in succession emanated not only from the centre crater, as generally happens with Vesuvius, but likewise fron numerous lateral vents, now forming the various minor eminences met with in various parts of the island. But it would not at all surprise us should an eruption of considerable local importance break out here at some later date, seeing that to a certain extent much analogy of constitution may be traced between the islands of Pantelleria, Lipari with its satellite Vulcano, and Ischia, in the two latter of which islands we know of more than one recorded eruption during historic times, although many authors seem to be disposed to classify them among extinct volcanoes.

In order to complete this rapid sketch of Pantelleria, off the coast of which a submarine eruption took place last October, preceded by earthquake shocks it will be useful to say a few words about the general configuration of the bed of the African Sea in this neighbourhood, between the coasts of Sicily and Tunisia.

In a direct line the distance by sea from Pantelleria to the nearest point in Sicily is 53 miles; to Africa it is only 34 miles. For a distance of 9 miles towards Sicily the greatest depth of water is from 130 to 240 fathoms, and in one spot it even reaches 315 fathoms. Further on towards Sicily the 100 fathom contour line, the deepest measurement found in that direction, embraces a wide area, the depth diminishing to the 50 fathom contour line as we proceed onwards from 3 to 5 miles. A slight upheaval of the bed of the sea of only 40 fathoms would convert the Adventure Bank, situated at about 40 miles from Pantelleria towards Marsala, into a long island, larger even than Pantelleria itself, measuring 14 miles long from N. E. to S. W. by 3 miles broad, and rising but slightly under 200 feet above the sea level.

Again: 37 miles from Pantelleria to the N. E. and 25 miles from the town of Sciacca on the south coast of Sicily, is the Graham Shoal, marking the spot where the submarine eruption took place in the year 1831, resulting in the formation of Graham Island, which before Christmas day of the same year sunk beneath the waves, never yet to reappear. The summit of this new volcano was seen for many years at a depth of only 10 feet below the surface of the water, but subsequently it subsided considerably, and in all probability this year it will have undergone considerable change of level, owing to the volcanic phemonona above alluded to. Several lesser submarine eminences are noticeable within the 100 fathom contour line, which is shewn by English soundings made in this neighbourhood to have a diameter of from 10 to 15 miles. Outside this contour line, at distances varying from 2 to 10 miles, the deepest soundings are to be met with, ranging from 130 to 169 fathoms—these latter depths being *nearest the shoal.*

Proceeding in the opposite direction, the 100 fathom contour line is never more than 12 miles distant from the Tunisian coast, and the greatest depths outside this line towards Pantelleria are from 172 fathoms to 250 fathoms.

In a word, generalizing: the greatest depth of the sea appears to be within the distance of only a few miles from Pantelleria; and from the Adventure Bank and Graham Shoal, which are submarine volcanoes, further off, the depth regularly diminishes in approaching land constituted of sedimentary strata. East of Pantelleria, in the direction of Malta, we find the two little volcanic islands of Linosa and Lampedusa, so that this is exclusively a volcanic region, characterized moreover by habitual lethargy rather than activity, a word scarcely applicable to any of the island volcanoes around Sicily, though *none of them are by any means extinct.*

Like Ischia, Pantelleria boasts of thermo-mineral springs, highly mineralized, which might assume much therapeutic and economic importance, yet in modern times they have never attracted attention, such as the Romans and Arabs at least gave them, if not former people, in centuries long ago passed into oblivion, for the Musselman were expelled from this island in the year 1147. They could not now be less known in Italy and elsewhere, even to scientific men, than if they had risen on the shores of the Victoria Nyanza; and *that is a vast pity, expecially, as far as regards Malta, to the inhabitants and visitors of which, these powerful medicinal waters might prove an inestimable blessing in numerous classes of chronic ailments.*

Is it permissible that such a state of things as this should persist a single year longer, or must we have to deplore that the recent volcanic eruption, which may be justly considered to be a huge advertising arrangement in an universal language planned by restless old Vulcan himself to attract travellers and invalids to his favourite haunts, has been merely a *mons parturiens*, with the signal of the *ridiculus mus?*

With due respect for such a high functionary of the British Government I cannot too strongly impress upon His Excellency the Governor of Malta the importance of delegating one or two of the most capable and energetic of the medical men of the island to proceed to Pantelleria at the public expense at the proper season, and stay there for a few months, in order to study with the utmost care the curative effects of the thermo-mineral waters, and plan the most practical and efficient method of sending patients there during the summer; indeed, many military men who are suffering from a variety of chronic complaints incident to their rough mode of life and rapid transfer from one climate to another, would find this place very convenient as to distance, expecially if they could combine to obtain steam communication occasionally with Malta.

But in order to effect all this it would be absolutely necessary to erect some decent bathing establishment on the spot, provided with the requisite apparatus of the most improved construction, and that, during the bathing season, it should be put in charge of an experience medical man from Malta, in default of which necessary precaution, waters of such strength might easily prove fatal to many persons ignorant of the diseases for which the baths were intended. In this manner Pantelleria might become a very important thermo-mineral station at a few hours distance from Malta.

This is but a very broad suggestion, but I feel assured that the civil and military authori-

ties, as well as the scientific and commercial men at Valletta, will not to allow such a practical suggestion to fall unheeded to the ground, and that the local press will generously reproduce these considerations to the greatest extent, insisting on their immediate actuation for the service of suffering humanity. *A few thousand pounds would suffice to carry out this plan and that in a practical and moreover, remunerative manner, and, once started the mineral-water and vapour baths alike would become very popular*, and would be patronized by many distinguished military men on their way home from India, burdened with various painful affections resulting from exposure to climate, and would enable them to return to England to pass the evening of life on their own beloved shores, invigorated in body and brighter in spirits.

I will not here repeat all I have elsewhere written on the subject of Pantelleria, or indeed of the mineral wealth and the mineral Springs of Sicily in general, but refer the reader to the volumes already published. * We will now give a rapid glance at them.

To the east of the island, round the lake, are the thermo-mineral waters known to the inhabitants under the name of *Le Candareddi de lu Bagnu.*

The *Bagnu*, improperly so called, is simply an ancient volcanic crater, formed of vitreous rocks about a mile in circumference: it is not far from the Bagno Secco. Owing doubless to the admixture of rain water, the temperature is lower than that of the Candareddu de lu Bagnu.

Northwards of this is the *Acqua della Grotta di Gadir*, consisting of several springs close to the sea shore, and owing their thermality and mineralization simply to the chemical decomposition of liparite and cossyrite in the presence of atmospheric influences.

About 12 miles from the town of Pantelleria, and at the S. W. end of the island, is the *Acqua della Cala Nita*, the most highly thermalized of any, a fact which is due to the decomposition of the white liparite: it is therefore easy to account for the thermality of the sea itself in this precise locality.

The *Acqua del Porto di Saura Basso*, on the same side of the island, some 5 miles nearer the town, is also very hot.

Proceeding northwards along the west coast, some 5 miles from the town, is the hot spring known as the *Acqua salina di Sataria*, supposed to have been used for baths by the Romans or Arabs. This spot is rather difficult of access by sea or land, being situated in a grotto. The water comes out of pumice stone underlying liparite, but it doubtless derives its high temperature and mineral constituents from this latter rock.

Next come the *fumaiolo*, or emanations of aqueous vapour, simply indicating the subterranean seat of strong chemical decomposition in the volcanic rocks, and termed the *Bagno secco*. This is situated in a little grotto in the midst of the rock, and forms *Stufa* or *Sudatorium*. The *di Khasan* was formerly employed by the Arabs *Stufa* as a *Sudatorium*. Another *fumaiolo*, called the *Favara Grande* is met with on the N.E. slope of Monte Russo.

As to the minerals met with in the island of Pantelleria, mention may be made of sulphur, formed in the ancient *fumaioli*, but in quantities too insignificant to be of any economic importance. Such is the quantity of alkaline bicarbonates in the waters of the Candareddu de lu Bagnu, and the Cala Nità as to react powerfully upon the silica of the rock in contact with them. It is first transformed into soluble gelatinous silica, and then deposited in the form of dirty white or gray opal. Obsidian is common among the volcanic products, and is due, as it well known, to the rapid cooling of the rock, such as takes place in submarine eruptions, similar to the one which manifested itself this autumn. Pozzolana and pumice stone are also common, besides minerals of purely scientific interest. But here I will stop for the present, hoping to persuade Prof. Cooke to devote some time to a visit to Pantelleria in order to enlarge our acquaintance with the geology of this interesting island.

Turin G. JERVIS.

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* *Jervis, G.—I Tesori sotterranei dell'Italia Vol. III,—Le Isole, illustrated.*

Jervis, G.—Guida alle Acque Minerali dell'Italia a Meridionale, illustrated.

The Botany and Geology of Egypt.

BY REV. PROFESSOR HENSLOW, M.A., F.L.S., F.G.S.

BOTANY. *

Egypt is conveniently divisible into five regions —(1) the Mediterranean, (2) the Nilotic, (3) the Oases, (4) the Red Sea Coast, and (5) the Deserts. The deserts are sub-divided into the Libyan on the west of the Nile, the Isthmian on the north-east; and the northern and southern halves of the Arabian, on the east side of the Nile.

(1): The Mediterranean coast being intersected by lakes and inland waters and salt marshes, plants peculiarly characteristc of saline areas find their natural habitats here. Thus the order Chenopodiaceæ, which contains several saline species, are well-represented, about two thirds of the species being found there—five out of seven species of Tamarix, and all the members of the Frankeniaceæ, &c.

(2): The Nile delta and valley are areas of cultivation. A number of introduced plants are found in these districts, but a peculiar feature which strikes one is the almost entire freedom from weeds amongst the enormous stretches of corn, clover, &c. This is probably due to the fact that the land is inundated for four months, which would kill any seeds left in the ground. With regard to aquatic plants, the Nile and artificial canals as a rule contain next to none, as the water is always muddy. The ditches and irrigating streams have a few, especially sedges; but of other plants the few following furnish the main supply: Two waterlilies, *Nymphæa Lotus* and *cærulea*, four members of *Elatinaceæ*, our familiar *Epilobium hirsutum*, two water-plantains (one being the British *Alisma Plarago*), a species of *Damasonium*, five of our English pond-weeds and *Ruppia maritima*, five species of *Naias*, four duck-weeds and one bull-rush *Typha angustata;* the ancient *Papyrus Antiquorum* being now extinct.

Nos. 3 and 4, are limited floras, and call for no special observation.

(5): The most interesting parts of the Egyptian flora are undoubtedly the plants of the deserts, in that they shew most remarkable adaptions to meet the extreme difficulties of their environment, in maintaining their existence against the intense heat, light and drought during ten months in the year.

As to the general character of the deserts, the appearance consists of a chaotic confusion of low hills and rock masses, with deeply-cut ravines (wadys) and valleys, resembling the numerous ramifications of streams, though now without water. They divide and rejoin, cutting up the desert into a landscape of wild confusion.

The vegetation is solely confined to the depressions in which water has flowed during the short rainy season. The year has two periods, February and March during which months rain falls, and the dry season lasting for the other ten months, during which time the vegetation has to depend to a very great extent upon dew for moisture.

At the end of January, a thick mist ushers in the rainy period, when the knotty stumps and bushes begin to put on their foliage, and young plants and annuals sprout up everywhere. From the beginning of May it all disappears, the annuals perish, and out of thousands of individual seedlings perhaps two per cent succeed in establishing themselves. There is no struggle for existence amongst the plants themselves—that is, between one another—but solely with their physical environment.

The general features of the perennials are gnarled and stunted stems of great hardness, and frequently spinescent. The leaves are very small and densely hairy, though some few are glabrous, thick and succulent. The surface is frequently coated with a waxy secretion. The thick coating of hair, and the glaucous hue due to the wax, conveys a blue-grey tint to the desert plants instead of the familiar green of our customary English flora.

A peculiarity, apparently in direct connection with the climate, is that certain individuals of normally annual duration may become biennials, and perennials, if their roots happen to run deep enough so as to be able to store up sufficient water to maintain the lower part of the stem alive; thus heliotropes usually after fruiting, but they may form coral-like roots if they go deep enough, which survive the summer: the excrescence being a sort of hypertrophied cortical tissue which acts as a reservoir.

On the other hand, perennials may perish at the end of the first year, if the local water supply be insufficient.

Each organ has some special adaptation to resist the difficulties of growth. First, with regard to roots. The first noticeable feature is their relative

* *Abstract of lecture delivered before the Society.*

ly great length; so that while the upper layers of the sand may be heated to 140 degrees F., the plant can still flourish since the root fibres extend to great depths. Thus, a plant of *Monsonia nivea* of one year has a small rosette of three or four leaves, the roots of which may be 20 inches in length.

The roots of some bushy plants have been found to be two yards and seven inches long. Some roots may even become twenty times the length of the stem. The Colocinth grows singly, has large soft leaves, without any means of preventing an excess of transpiration, for a cut shoot fades within a few minutes; yet it flourishes unshaded through the whole summer.

On some roots tuberous swellings occur, which would seem to act as reservoirs of water; such occurs on species of *Erodium*,

With regard to stems, they are often knotted and gnarled at the base with a stunted growth. When they grow to good sized bushes, they are often spinescent. One of the largest, and a typical desert plant, is *Zilla myagroides*. In some cases they are almost or quite leafless, thus reducing the transpiring surface to a minimum.

The anatomy of many stems shew the whole of the cortex to be converted into a colourless water-storing tissue; the elements consisting of long thin-walled cells, which store up water absorbed by the roots or leaves, or both, this cortex subsequently forming a dense layer of cork, which acts as a protection. In some cases, the pith acts as storage instead of the cortex.

A common form of stem is the spine, but spiny processes are often homologous with leaves, as in *Astragalus*, *Fagonia*, &c. These spines, besides being hard in consequence of the poverty of water, which always reduces the amount of cellular tissue, act as a storage of such water as the plants can get.

The peculiarities of the leaves of desert plants are certainly the most noticeable, they being mainly centred in securing protection against loss of water by transpiration.

First as to the epidermis and cuticle. The latter is much thickened and often coated with wax, and strongly striated. The hairs are often entirely or partially coated with wax as well.

Hairs form one of the most general kinds of protection, often forming a dense felt over the surface when they are stellate, by their rays thickly interlacing. The hairs, besides acting as non-conductors, also act as absorbents as well, for dew is of course retained by a felt-like mass. Even when the hairs are coated with wax they may be partially free from it at the base, or gashed and riddled with holes through the waxy layer, allowing dew to be absorbed. The interior walls, both of the hairs and epidermal cells, may become more or less of a mucilaginous character by the absoption of water, and thus tend to retard subsequent evaporation. Just as in all the storage tissues the water becomes thickened, so that its loss by evaporation is greatly hindered. In some cases there are jointed hairs which act as storage, *e. g.*, *Atriplex deserti*. If the water becomes exhausted, these hairs collapse and stick together, forming a parchment-like layer over the epidermis, affording a strong and excellent protection against excessive transpiration.

The epidermis is often a storage tissue, the cells bulging both outwards and inwards forming bladder-like structures, scattered thinly or thickly, or in rows over the surface of the leaf. The ice-plant, which grows about Alexandria, is a familiar example.

With regard to the form of the leaves, the size is mostly very small or even minute. If they be deeply divided, the lobes will be very narrow. The edges are often wavy or inrolled. When first formed on the commencement of the rainy season they grow larger, but during the drought these sometimes perish, and smaller leaves only are produced.

The anatomical structure is also correlated to the environment. The chlorophyllous tissue is very dense, palisade cells being on *both* sides, while the mesophyl is compacted with polygonal green cells. In some case the mesophyl acts as a storage tissue. This occurs, *e.g.*, in aloes. Under the epidermis is a large layer of chlorophyllous tissue, which covers the central mass of thin-walled rounded cells, containing a colourless semi-fluid matter, which, when extracted, hardens into the bitter aloes of pharmacy; while living, however, it appears to acts as a storage of water, the bitter substance held in solution probably preventing the water, from evaporating, just as in other plants it becomes mucilaginous or gummy.

Besides the above features, one of the most remarkable is the secretion of salts, which are

highly hygrometric and absorb the dew, which they transfer into the interior of the plant. One of the best instances is *Reaumuria hirtella*, allied to *Tamarix*, which also does the same to some degree.

Reaumuria is a shrub growing sometimes to two or three feet high. After rain and the leaves have been well washed, on the following morning the leaves are found to be covered with drops, the result apparently in this case of root-pressure. As the day advances. the leaves become dry and are then covered with a fine powder, consisting of salts of chloride of calcium and of magnesium. These are secreted by special glands in the epidermis. They act as absorbents when the rainy season is over, and the plants have to depend almost entirely upon the dew for their supply of moisture.

The above constitute some of the more remarkable structures which enable desert plants to thrive in the most inhospitable region of the world.

(To be continued.)

Military Pigeons.

Since the success of the carrier pigeon service during the siege of Paris in 1870-71, European governments have given considerable attention to the rearing and training of pigeons. In France, according to Lieut. Col. De Rochas, most of the fortresses now contain dovecotes, and 47 departments have private societies for pigeon training, the total number of trained pigeons in the country being about 100,000, and Paris alone having 8,000 trained and 10,000 untrained pigeons. In Germany there are about 20 military pigeon stations, and in 1888 there were 78 private societies with 52,240 carrier pigeons. In Italy there are dovecots at 23 military stations. Spain has a very complete system of pigeon service, dovecotes having been established at 18 stations, the greatest distance between any two designed to communicate directly being from Madrid to Malaga, 240 miles. In Portugal there are 14 stations, in Russia, 5 stations, that at Brest-Litowsk having 1000 pigeons; in Switzerland, 4 stations; in Austria 2 stations and several projected ones; considerable government encouragment being given also to private trainers. Sweden has one station; Denmark, a private society in 12 sections; Belgium, many private trainers, with an estimated total of more than 600,000 pigeons. Holland has a regular pigeon postal service between Java and Sumatra; and England, a number of cotes in garrisoned cities.

Theories of Mountain Formation.

BY T. MELLARD READE, C.E., F.G.S., F.R.I.B.A.

Part III.

In concluding the last article I promised to explain in what way the illustration given of the effects of expansion on various materials bears upon the origin of mountain ranges.

But before doing this I must ask the reader to pardon a little digression, as I wish to call attention to the discussion which took place at the Geological Section of the British Association on the 10th of September 1888 on Profesor E. W. Claypole's paper entitled a (1) "Note on Some Recent Investigations into the Condition of the Earth." This paper dwelt with the discovery of a "level-of-no-strain" in a cooling globe already explained in the first article.

It so happened that none of the men whose name are associated with this investigation were present, and as I was admittedly fortunate enough to be the first to announce the discovery (2) it may not be inappropriate for me to correct some of the misconceptions that seemed to prevail among the disputants. Professor Claypole said—"Of the actual existence of such a zone, after a careful study of these investigations, scarcely a doubt can entertained," but suggested that the numerical calculations of the depth at which it now lies might be in error, as we have many examples of rocks being "forced up from a depth greatly exceeding this limit." The speakers who followed mostly contended that such a neutral zone, where the cooling produces neither compression nor extension, could have no existence, as there were examples in all quarters of the globe shewing that rocks had been squeezed, contorted, and forced up from much greater depths. The President most emphatically wound up the discussion by declaring his utter disbelief in the existence of a "level-of-no-strain" in our earth, having arrived at this conviction through his geological experience, which

(1) *Reported in Scientific News, Sept. 14th 1888.*

(2) *Origin of Mountain Ranges, chapter XI.*

told him that the deepest and oldest rocks were the most crushed and folded, whereas on the "level-of-no-strain" theory they ought to be the least disturbed.

These sentiments—for a good deal of it was geological sentiment and righteous indignation against mathematicians—caused me much amusement. Anyone may see for himself who takes the trouble to study my "Origin of Mountain Ranges" that similar geological arguments are therein used to show that mountain ranges have not been thrown up by compression induced by the earth's contraction, which compression, as is proved by the discovery of the level-of-of-strain in a cooling globe, does not even now affect the earth's crust below the depth of a few miles. This was, in fact one of the many reasons which induced me to look for another origin for the earth-foldings distinguishing mountain regions.

The speakers referred to at the British Association, unconsciously begging the question, took it for granted that earth-foldings and contortions could be produced in no other way than on the shrinking-apple system, therefore the "level-of-no-strain" was a myth—an invention of the enemy, the mathematician and physicist. Q.E.D. Let us now see if there is not a method of explaining these wonderful evidences of pressure found in mountain regions without invoking secular contraction as the direct cause, and in a way more consistent with geological facts, which, as I before said, must be our guide and court of appeal in forming theories of the earth.

As already pointed out, the effect of the deposition of sediment is to raise the temperature of the underlying rocks. For the sake of employing round figures in illustration, let us say the heat gradient or rise of temperature downwards in a given area of sedimentation is 100° per mile=1° per 52·8 feet, then the accumulation of 10 miles in thickness of sediment would raise the temperature of the underlying rocks 1000°, the sediment themselves taking at the surface the mean yearly temperature of the locality say 50°, and at the base being 1000° hotter. The mean rise of temperature of the 10 miles of sediment would then be 500°.

Such a thickness of sediments may seem astounding to those who are unfamiliar with geological facts, but the most eminent geologists tell us that the combined thickness of the strata of many great mountain ranges reaches this limit. As such a depth is twice as great as any known part of the ocean, it may justly be inferred that the weight of the pile of detrital matter has helped to displace the foundation matter of the globe upon which it has been built.

The underlayers at some unknown depth in the earth have flowed laterally from the area of sedimentation outwards, but of the manner in which the surrounding rocks are affected we have as yet no direct geological evidence.

It must be understood that these operations of Nature take periods measured by millions of years and during this time with increasing weight, heat, and chemical action, the unsolidified deposits get consolidated into beds of rock capable of withstanding considerable lateral stress. As they are solidifying they are increasing in temperature and exerting a lateral thrust which is buttressed by the surrounding rigid area of old rocks, while the beds themselves are kept from rising in folds by the weight of sediment with which they are loaded.

But not only are the sediments themselves affected by these internal stresses: the underlying old and rigid foundation rocks are subjected to still greater stresses, as their mean temperature has risen twice as much as that of the overlying sediments. In addition, they are less capable of being squeezed into a smaller compass.

We see, therefore, that all the rocks in the area of sedimentation are subject to two opposite forces—one of increasing expansion by heat, and the other of increasing and countervailing vertical pressure by loading. The piling up of the sediment at first proceeds at a more rapid rate than the mean rise of temperature of all the underlying crust of the earth due to the deposition of the imperfectly conducting covering of new rocks. The sediments themselves also become worse conductors of the outflowing heat of the globe, as they lose their water by pressure, wet rock being a much better conductor than dry rock, as conclusively proved by experiments in the laboratory.

To what extent, then, can mechanical pressure resist the tendency of rocks to increase in bulk by rise of temperature. We really have no satisfactory data to go upon as regards *cubical* expansion, but

as regards *linear* expansion it is found that an increase of 14° Far. will expand wrought iron $\frac{1}{10}\frac{1}{000}$ and steel $\frac{1}{15}\frac{1}{000}$ while, on the other hand, one ton in weight per square inch of section will compress iron and steel to the same extent. A rod of rock 10 miles long (the thickness of our sediments) and and one square inch in section would weigh about 30 tons. I am not aware of any experiments on the compression of rock within elastic limits having been made; but, for the sake of illustration, were the co-efficient the same for rock as wrought iron a rise of temperature of 420° at the bottom would be required to balance the vertical weight and keep the length intact if the rod were placed on end. This illustration is merely given to enable the mind —however imperfectly—to grasp to some extent the nature of the forces to be dealt with. It is thus seen, if the preceding proposition be granted, that that a time must come when the forces of expansion over come those of weight. What will then happen?

Many geologists aud physicists have speculated upon the effect of expansion upon the rocks of the earth's crust. It is a strange fact that almost all have considered only linear vertical expansion. A very little consideration will, however, serve to show that the rise of temperature of a given section of the earth's crust will expand it in three directions, that is cubically; but as the lateral expansion in two directions is resisted by the surrounding areas, the tendency is for increase of bulk to take place vertically, thus making the mean vertical rise of the whole heated area three times what would result from linear expansion alone.

But, as I have pointed out in Chapter IX. of the "Origin of Mountain Ranges" the increase of bulk of the heated area would tend to dispose itself along lines of weakness, so that instead of the mass being elevated over the whole area it would rise in ridges. I have satisfied myself of this by experiment, but to prove it in detail here would take too much space. Those who wish to be informed further had better consult the plates of the original work.

The greatest internal stresses will exist in the base of the deposits and the original underlying rocks, and those subject to the overlying weight and the enormous expansive force within them will flow like lead under a die. This is no fanciful statement but one proved by geological investigation of the earth's crust, when it is seen that the most rigid rocks have been bent, folded, squeezed, lengthened or thickened in the most extraordinary manner. But in the case of old massive gneisses or complexes composed of igneous rocks, it has sometimes happened that the yielding has been by shearing, whereby enormous masses of rock have been bodily shifted along fault planes, such as have lately been described by the Geological Survey as existing in the Highlands of Scotland. In other cases, as in the Appalachians, when folding could go no further, shearing has taken place in the same way. In this manner old formations have been piled upon younger ones in a way to deceive the eye of even the practised geologist, who thought he was looking upon a regular and natural sequence of rocks. Indeed, patches of rocks have been bodily shifted considerable distances, and it is only just lately owing to the labours of many geologists that this fact has been fully recognised and the complicated structure of a typical mountain district is now in a fair way of being unravelled.

But it will no doubt be asked how can the small increase of bulk caused by expansion effect such tremendous results? The best answer to the question is by a calculation. I set no value on statements or theories involving *quantity* unless they be reduced to figures, The best way to prick a scientific bladder inflated by the theorist who despises numbers is to put it into figures. Were the author in every case to perform this for himself, many grand theories would never see the light, excepting it be that of the fire!

Let us consider what increase of bulk would ensue from the heating of an area of the earth's crust, 500 miles by 500 miles, and 20 miles thick to a mean of 1000°. Fahr. Such a cubic mass is very much less than many areas which have been affected by sedimentation in the way already pointed out. The increase of bulk due to expansion would in round numbers amount to 78,000 cubic miles, which is not a bad material capital to begin our mountain building with.

If we allow 26,000 cubic miles for loss by compression and in other ways we shall have 52,000 cubic miles left for effective mountain building or sufficient to form a ridge of triangular section 500 miles long, 50 miles wide, and 4 miles high.

There are, of course, many intricate details and agencies that cannot be discussed in an article of limited scope, like the present one. When we come to consider the actual structure of known mountain ranges, it will be the time to inquire whether internal stresses by increase of bulk through expansion by heat can account for their characteristic forms and structure.

There is, however, another important principle which must not be overlooked. It is this: Every rise of temperature, however small, goes towards the lateral pushing up of mountain ridges. The rocky material by expansion is actually moved by slow degrees towards the *locus* of the mountain range whereby its bulk grows; subsequent contraction cannot bring it back again any more than it can efface the ridging up of sheet lead caused by small increases of temperature already referred to, consequently the effects are cumulative. Contraction is the cause of a different set of phenomena, which will be considered in another article. One aspect of the question will be readily apprehended. It is this: The greatest stresses are by this theory the deepest seated, which accords with the facts insisted upon at the British Association discussion, and urged as fatal to the existence of a "level-of-no-strain" in the earth, namely, that the oldest and deepest seated rocks generally show the most evidences of pressure. Such facts do not disprove the existence of a "level-of-no-strain" in the earth; they only show that we must look to another source than the contraction of the earth for the cause of mountain upheaval and indicate that other forces come into play which obscure, if they do not obliterate, the mathematically-deduced effects of the contraction of a cooling globe.

The theory of which this is but a slight outline I designate "A Theory of the Origin of Mountain-Ranges by Sedimentary Landing and Cumulative Recurrent Expansion

(to be continued).

The Climate of the Maltese Islands.

"Adieu, ye joys of La Vallette!
Adieu, sirocco, sun and sweat!
... ...
I'll not offend with words uncivil
And wish thee rudely at the Devil;
But only stare from out my casement,
And ask, for what is such a place meant?"

BYRON.

And yet there are few places situated within the same parallels, that enjoy so equable a climate as do the Maltese Islands.

The short sojourn made by the ordinary visitor is not of sufficient length to allow of a just estimate of the climate being formed; and, moreover, situated as the principal city of Malta is, in the most unpicturesque, and uninviting part of the island, where there is neither tree nor shrub, hill nor valley to relieve the monotony of the long-drawn swellings, and undulatory outlines that sweep from the eastern extremity of Malta to the foot of the Binjemmas, the tourist has but few opportunities of seeing the more fertile districts, and so the impressions that his short acquaintance with the "Fior del Mondo" make on him, are often the reverse of being favourable, and the disappointment that is thus engendered finds vent in an indiscriminate condemnation of all and everything connected with the place, in the course of which the climate receives its due share of opprobium.

That the strictures passed on the climate are unjust, may best be proved by a brief consideration of the principal facts connected with the meteorological phenomena of the islands.

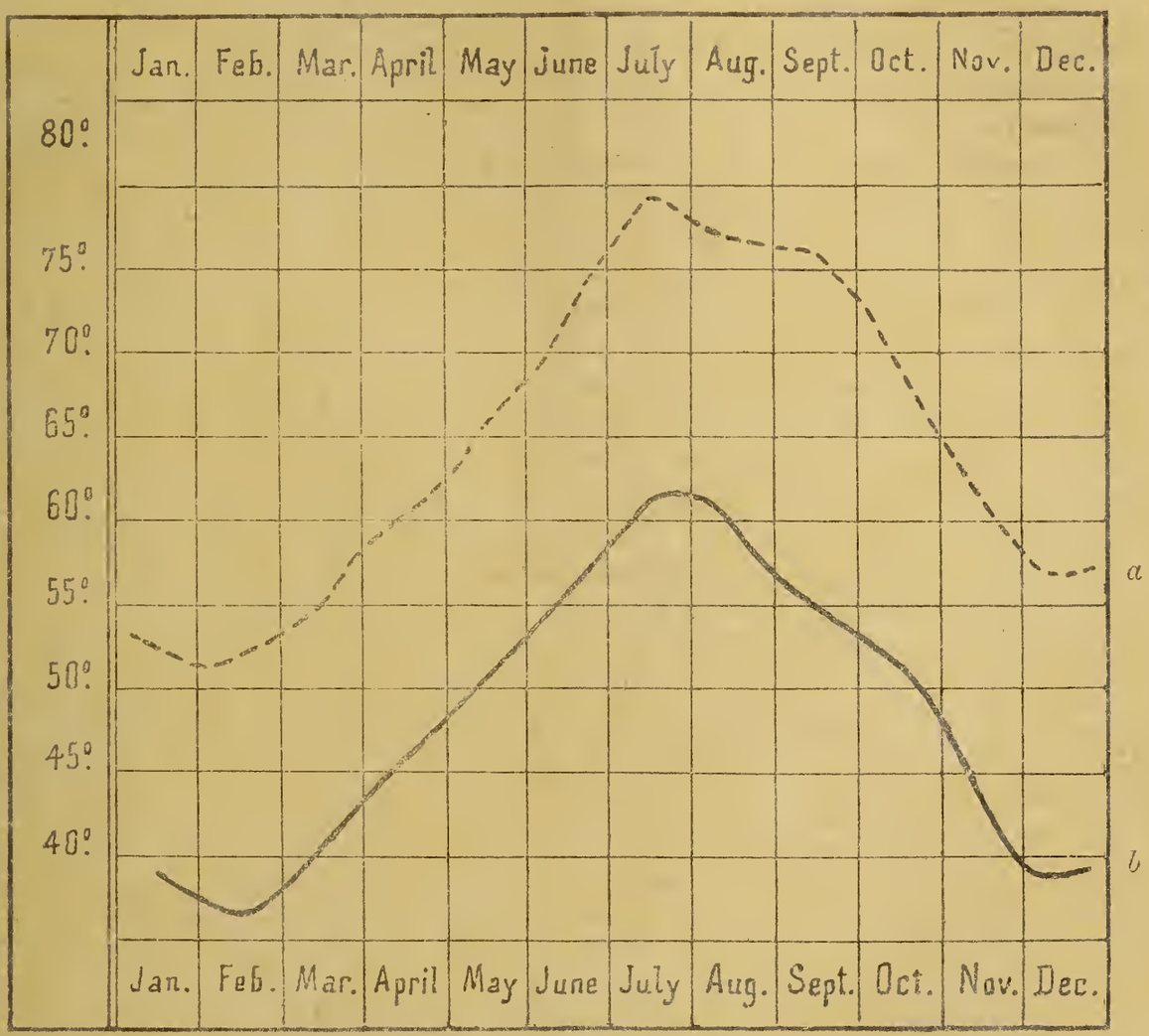
The geographical position of Malta and Gozo, serves as a fair index of the nature of the meteorological conditions, that the physical geographer might expect to find.

Situated in the midst of an extensive land-locked sea, the waters of which serve in the summer to modify and cool the blasts that sweep over from the burning plains of Africa, and in the winter to raise the temperature of the icy winds that blow from the snow-clad summits of the mountains of southern Europe, the Maltese Islands may be said to occupy a unique position; for the equalizing influences of the surrounding waters render them much less subject to variations of temperature, aud while they enjoy the mild and bracing springs that characterize the areas on either side of them, they experience neither the extreme heat of the southern summer, nor the piercing cold of the northern winter.

In order that the nature of the differences that exist can be the better appreciated, I propose in the following brief observations to institute a comparison between some of the meteorological phenomena of these islands, and similar phenomena in the south-east of England; and for this purpose, and to avoid entering into wearisome statistical details, I shall consider the climate of the two areas under the broad headings of the distribution of heat during the different months and seasons, the variations of air pressure during the same periods, the rainfull and its distribution during the year, the dryness or moisture of the air, and the prevailing winds.

With reference to the temperature, records show that the thermometer has a smaller range in Malta than in any other place in or around the Mediterranean.

From the summary of observations which is published every month by the Jesuit Fathers at Malta, it will be seen that the annual average temperature of the island is 64½° Fah., and the following diagram will show how very little it varies from year to year.



a. Range of Temperature at Malta.
b. Range Temperature at Greenwich.

The significance of these calculations is the more clearly seen when we remember that the average adopted mean temperature at Greenwich is 49° Fah. By comparison, therefore, with the temperature of Greenwich, that of Malta would *prima-facie* appear to be but 15½° warmer, but this does not in the least represent the important differences that really exist.

In order that the relative average temperatures in the two countries may be compared, it is necessary to take the various seasons seriatim.

The following tabular statement will indicate more exactly the real extent of the variations.

	Greenwich	Malta
Spring, (March, April and May)	46.9°	60.8°
Summer, (June, July and August)	60.6°	72.6°
Autumn, (Sept., Oct. and Nov.)	49.9°	68.4°
Winter, (Dec., Jan. and Feb.)	38.2°	54.4°

By means of these data it will be seen that the Winter and Spring seasons in the Maltese Islands correspond to the English summer; while the temperature of the Maltese Summer and Autumn is but approximately 12° in excess of that of England. But it is not so much by the actual mean height of the thermometer, as by its range, that the climate of the Maltese Islands should be judged.

In England, this range is often very great especially during the Winter, Spring and Autumn months, for then, days that have been warm, are often succeeded by evenings that are very chilly, and even frosty. In Malta such ranges of temperature as these are unknown at any time of the year; and the climate is therefore more equable and less liable to injuriously affect either animal or plant life. The thermometer indicates throughout the year a gradual rise and a gradual fall. The extent of its variations will be understood by referring to the following table which shows the mean daily range for every month of the year, contrasted with the temperature at the same time at Greenwich.

Month	Greenwich	Malta
January	10. 0°	10. 6°
February	12. 3	11. 7
March	15. 2	12. 4
April	19. 1	13. 3
May	20. 2	15. 0
June	20. 8	14. 8
July	21. 3	16. 9
August	20. 0	15. 4
September	19. 8	14. 1
October	14. 6	11. 4
November	11. 7	10. 8
December	9. 5	9. 8

It will be seen from this table that in Malta, as in England, the greatest range occurs in July when the days are longest; and the smallest range in December, when the days are shortest.

But while the absolute mean temperature of Greenwich in July averages 61. 8°, that of Malta is 72. 6°, a difference that renders the English summer evenings much more bracing than are those of Malta, though the liability to colds and analagous diseases is much greater in the former than in the latter country.

In winter, on the other hand, while the average mean at Greenwich is 36.3° (Jan.) with an average range of 10°, that of Malta is 53° with the same range. The Maltese winter is therefore equivalent to the finest of English Springs; and it is generally characterised by fine, cool, and bracing weather.

The effect of this equability of the Maltese climate is strikingly shown by the vegetation which flourishes luxuriantly for fully nine months of the year in the rich and fertile soil that clothes the plains, and the slopes of the hills and valleys. Arboreal vegetation is rare; but this is due to the want of a sufficient depth of soil, for where-ever trees have been introduced, and properly cared for they have flourished vigorously. Grapes, melons, and tomatoes are cultivated in the open fields.

These facts sufficiently indicate the mildness of the Malta climate, but neither these nor thermometric results furnish such conclusive evidences as does the growth of exotic plants in the open. Thermometric results are often deceptive and do not furnish an accurate standard of comparison as regards the temperature that actually affects the body. Thus given two days with the same conditions as to sun and sky, but on the one a brisk breeze is blowing, while on the other no wind arises, the former will seem much warmer and more agreeable than the latter. And yet the thermometer will probably register the same degree on both days. This difference in the *felt* temperature is due to the rapid evaporation from the surface of the body that has been induced by the current of air. The thermometer therefore cannot always be looked upon as an unfailing index of the sensible temperature of a climate: but the state of its vegetation furnishes a faithful picture of its true characters.

In both Malta and Gozo exotics of extraordinary beauty and vigour thrive in the open all the year round. During July and August there is a dearth of vegetation in the more elevated parts of the islands, owing to the very small rainfall of those months; but in the valleys and along the outcrops of the marl beds, the water-bearing stratum of the Islands, agriculture is carried on all the year round.

Except during the prevalence of the Sirocco, the air of the Islands is seldom saturated with moisture. The greatest degree of humidity occurs in December, January and February, that is during the coldest months of the year, while the least extreme of humidity occurs in July, the hottest month.

The absence of swamps, marshes and other similar natural water receptacles must influence the climate, too, in a minor degree, and tend to render the air less humid.

The mean annual rainfall varies but slightly from year to year; and at no time is it excessive. Compared with the mean-rainfall of the countries bordering the north of the Mediterranean which averages 33 inches, that of Malta is small. Thus the mean average rainfall of 1886-1887 was but 17. 6 inches, while that of 1888-1890 was 20 inch. and in 1889 it was as high as 26. 044. The previous year 1888, however, it was but 13. 7 inches, the great difference being due to the delay of the winter rains of 1888 until January 1889.

The average rainfall of each month during the above period was 1. 7 inches. January, November and December are the wettest months of the year; while June and July are the dryest.

It is an exceptional occurrence for rain to fall in July. The average fall for July for the past 8 years is zero. The months in which rain fall during the smallest number of days are May, June, July, and August; and during the greatest number of days in January and December. The proportion of fine days to wet ones is, however, very large even in the wettest season of the year. Thus the mean average for the last 8 years has been 12 days for each month.

Estimating the total area of all of the islands as being 117,361 square miles (such was the result of the official survey made by Lieut Worsley R. E.), and the mean annual rainfall for the last eight years as being 19 inches, we find that the total quantity of rain that falls on the islands per year amounts to 32,451,700,000,000 gallons, or about eighty billions of gallons per day.

Reckoning the population of the islands at 160,000, this gives 500,000 gallons per individual per diem, an allowance that the thirstiest of mortals find but little cause to grumble at.

There are however, many deductions to be made such as the absorptive nature of the Globigerina limestone that occurs as the surface deposit of upwards of two-thirds of the total area of Malta and Gozo, and which is capable of absorbing and retaining about one sixth of its own weight of water; the water that is lost by evaporation, and by fissures in the valley beds; the torrents that form immediately after the storm, and which rush onwards to the sea with the boiling, eddying storm waters that have been collected from the surrounding slopes; and the absorptive power of the vegetation in the fertile parts of the islands.

But large quantities find their way into the underground natural reservoirs that have been formed in the limestones, while greater quantities still are retained, at the surface of the marl bed which lies interstratified between the two great limestone beds of the island.

The water supply of the island might-therefore be almost considered as being inexhaustible.

Another most important factor in influencing the climate of the Islands is the distribution of the winds. The absolute force of the wind on an average is never great, though the islands are occasionally visited by storms of considerable fury. From the measurements, as recorded by the instruments at the meteorological station of St. Ignatius's college, it is shown that the greatest absolute force is generally attained in January and December, during which months north-westerly winds prevail. In September, October. and November there is a preponderance of wind from the south-east, and it is to its debilitating effects that the adverse opinions, that are occasionally passed upon the climate of Malta and its dependencies, are to be attributed—opinions that are often largely influenced by the particular state of the individual's constitution.

This wind, which is called the Sirocco, blows directly from the dry, arid plains of Africa, and, though its enervating heat is considerably modified by the passage across the waters of the Mediterranean, yet it arrives on these shores, ladened with moisture, and, by overshadowing the islands with a dull, leaden-hued canopy of clouds, and by depositing its clammy moisture upon everything whith which it comes in contact, it gives the inhabitants unequivocal proofs of its presence.

It acts prejudicially upon the constitutions of natives and foreigners alike; but it varies in the degree in which it affects differently constituted individuals. It generally gives rise to a feeling of lassitude, and is often accompanied by dispepsia of an acute form. It has its commercial drawbacks too. Whilst it prevails, many trades have to be in part suspended. Neither paint, nor glue will then set; and wood quickly warps and splits. The usual period for which it lasts is three days; but during the months of September, and October it often blows uninterruptedly for a whole week.

The struggle for pre-eminence that takes place between this wind and the north-easterly winds, which are known as "Gregale," generally leads to thunderstorms during the course of which lightning plays in the sky with extreme frequency and brilliancy.

The rainy season is usually ushered in about the time in the Autumnal equinox by a "Gregale." In the summer months, June, July and August the heat of the sun is considerably tempered by the land, and see breezes that then blow, so that the heat of these months is never felt during the same period of the year, to the same extent as is that of the cities of Southern Europe.

The azure blue of the Mediterranean sky, and the remarkable clearness of the Mediterranean atmosphere are proverbial.

In Malta both are particularly exemplified. Save during "Gregale, "or "Sirocco" the sky is seldom completely overcast. Estimating a completely overcast sky as being 10, the average mean amount of cloud for the last eight years is but 3· 5, and in no month of the year does it exceeds 5. The minimum is generally reached during July, when the brilliancy of the atmospheric effects are often of a remarkable character. It is no uncommon occurrence for the inhabitants of Malta to be able to distinctly see Etna, and the coast line of Sicily, which are situated upwards of a 100 miles away, with the naked eye. The unusual clearness of the air, and the irregnlar diffraction that is thus caused from water into air, raise the line of sight; and therefore objects that are really below the horizon are brought within the field of view.

Fogs but rarely occur, save in the early part of the day during the winter months. Occasionally in the summer, light mists form, but these gather together in the grey twilight of the early morning, and rapidly dissipate into nothingness as soon as the morning sun rises high enough to make the influence of its rays felt.

The atmospheric effects of these swathing, gauze-like, summer mists are often very fine; but they will not compare with those that accompany the setting of a Mediterranean sun.

A Malta sunset in the winter time is something to see and to admire. Nature then indulges in her most capricious fancies, and chequers the heavens with forms of every conceivable shade and hue.

The slopes and summits of the hills are enveloped in fantastic cloud masses, that exhibit the most gorgeous colourings, from amid which, wraiths of crimson and purple peep forth and illumine the country round with a mellow light that tones down and softens the irregularities and the harsher features of the landscape, thus imparting to them for the nonce a charm of appearance such as they never appear to be invested with upon any other occasion. And crowning the whole is the sun itself, a molten mass of unsurpassed loveliness, bathed in a glorious flood of light; and as it slowly sinks behind the distant hills, it radiates outwards and upwards streams of living gold, some of which fall aslant the verdure covered slopes,

while others, penetrate the heavens and stand out as an effective contrast to the rich tints that surround them.

And as the light wanes, and the kaleidoscopic changes of colour become less marked, so the charm of the scene increases, until the sun finally disappears behind the ridges of the western plateaux.

The colourings then melt away, the clouds disappears vapourously, the twilight deepens, and in a short space of time darkness creeps in and rapidly envelopes the land in the mantle of night.

In the foregoing observations I have endeavoured to show that the climate of the Maltese Islands does not deserve the severe strictures that are so often passed upon it. It will compare favourably with the most frequented of Mediterranean health resorts. The lack of a diversified landscape, the limited area of the islands, the exile from home associations, and the monotonous routine of island life,—these are some of the causes that play the greatest shore in upsetting the digestion, and in inducing those feelings of dissatisfaction and querillity that are so often attributed to the ill effects of the islands' climate. There are of course occasions when the climate is trying; but such are not frequent, and taking it all the year round, in no part of Europe is the same degree of mildness and equability to be found.

JOHN H. COOKE.

Notes on the Lepidoptera of Malta.

(concluded.)

Nymphalidæ. Gen. Vanessa T.

12. Atalanta L.—Malt. *Farfett-tal-horriek*, It. Vanessa talanta. Eng. Red Admiral. Frequent in gardens, valleys, and fields during the year particularly in Autumn. The larvæ feed on nettles.

13. Cardui.—It. Vanessa, Eng. Painted Lady. Very common all the year round in open and sunny places, rocky plains, gardens, fields etc; but less frequent from November to February. The caterpillars feed on mallows and nettles, and are very abundant in autumn when changing into *pupæ*, they either develop themselves after a few days, or spend the winter under stones or attached to the branches of trees.

Satyridæ. Gen. Pararge Hb.

14. Megaera L.—Var. Tigelius Bo. Eng. Wall Brown. Frequent on walls, in roads, and in uncultivated places between February and November: but in winter it is less common. I believe that our form, like the Sicilian one, must rank with the *var. tigelius*.

15. Aegeria L.—Eng. Speckled wood. or Wood Argus. A localized species. It is limited to gardens, and fertile valleys like Gneina, Boschetto, Imtahleb, Ghirgenti, Uied-el-gbir, Uied-Encita, etc. It is common in these localities from March to November; but in winter it is rare.

Gen. Epinephile. Hb.

16. Janira L.—Var. Hispulla Hb.—Eng. Meadow Brown. Very common between March and October in fields, gardens and valleys. The male is often of a dark brownish colour.

Gen. Coenonympha Hb.

17. Pamphilus L.—Eng. Small heath. Common from March to November in dry places and rocky valleys, fields, etc. together with the *var. Lyllus Esp.* which is, however, rarer. Corradino, Encita, etc.

From this catalogue it will be seen that I was justified in alluding to the comparative unimportance of our butterflies: besides, the affinity of the Maltese fauna to that of Sicily is also confirmed here, for it will be seen that *all* varieties are common to the two islands, i. e., *V. sphyrus* of the *P. machaon*, *V. eleus* of the *P. phlæas* v. tigelius of the *P. maegera*, and the v. lyllus of *C. pamphillus*, and that no forms are found in Malta that are not also found in Sicily.

The lack of the most delicate and beautiful forms when compared with those of the neighbouring Island is a remarkable feature which is due, I believe, to the unfavourable climatic conditions and to the insufficient protection that they find here.

From our not having, in fact, mountains or hills of any considerable height, no alpine species are to be found; the absence of woods next, and the scarcity of trees, whilst depriving many lepidoptera,— those with dendrophagous caterpillars, —of their means of subsistence leave the various species exposed to the wind and to the winter rains, to the burning sun and to the drought of the summer months. It follows that our species, which are of the commonest in Europe, are of that class that are the best adapted to withstand atmospheric influences and that enjoy a very wide distribution.

Our butterfly-fauna are generally characterized by a great uniformity in their colours, which is necessarily owing to the small number of species

—which causes the frequent occurrences of the same forms; and from the want of contrast in the markings and colour. Beside, thir abundance on the continent takes from them much of the interest that the collector might otherwise have had in them.

Thus of the elegant *Vanessae* we have only the *V. cardini* and the *V. atalanta* and these occur in great numbers. Of the *Theclae*, *Melitae*, the *Arginni*, the *Melanargiae* and of the family of the *Hesperidae* we have none; and only two species of the pretty *Licenae* are found. But on the northern coast of Africa and in Sicily all of these genera are largely represented.

The non presence of plants adapted for their nourishment affords another reason for their absence; but it is not such that double the number of species might not find nourishment on our indigenous plants. The nettle is very common here, and we have not the *Vanessa io*, nor the *Urticae;* the *Parietaria* is extremely common as well, but the *Vanessa egea* is not met with; *P. napi*, *A. crataegi*, *Thais polixena*, and many of the *Arginni* and *Satiridae* which do not grace our country would also be able to find nourishment here.

With regard to the predominant colours, as one would expect, the light ones prevail and yellow is the most common. This led me to observe many times that it is really the best protection of the species which are more frequent from May to September, as they are scarcely visible on the soil covered with dry grass and parched herbage.

Besides the relative rarity of the females in comparison with the males I note that the observation made by Messrs Palumbo and Failla Tedaldi on the Sicilian species, that the summer forms are of a deeper colour and are much smaller than are those that prevail in other seasons, applies also to us.

Lastly the best time for collecting is spring and autumn, when in the course of a ramble through the country one is sure of meeting almost all our butterflies. In winter most of the species are not to be seen and the others are never frequent.

My notes refer to the general features of our butterfly-fauna, and, as I said, they are the result of observations that extended over but a short period. I make no pretensions of having exhausted the subject, but I wish on the contrary that further diligent researches may make additions to the list which I have given; still, I do not think that there will be much to add to it; but with reference to the moths I am in hopes of collecting a good number of interesting forms, which will enable me to do with them what I have already done with the butterflies.

Note—To confirm what I said with regard to the absence of *Colias hyale* from Malta, Mr. Ph. de la Garde, R.N., has comunicated to me a letter which he had received from Mr. Kirby of the British Museum, who had determined for him as *Colias edusa, var. helice Hb.* a pale form taken by him at Marsa in May last, a variety which was mistaken for the *hyale* from which it could never be distinguished when on the wing. In the same month Mr. Briffa showed me another fine specimen, almost perfectly white and with very dark wings, of this variety of *C. edusa*, which he had also taken at Marsa, coupled with a typical male of the deepest yellow. I think therefore that *C. hyale* may with certainty be eliminated from the list of Maltese species, substituting in its stead *C. edusa, ab. helice Hb.* which though much rarer is found in the same localities as the typical form.

ALFRED CARUANA GATTO.

Science Gossip.

A new scientific periodical is about to be published at Florence under the title of "La Natura." It is to be a "Universal review of the natural sciences and of their applications."

A French experimenter has discovered that if a mixture of hydrocarbon vapors and air is led over a specially arranged platinum apparatus, the latter becomes heated almost to fusion, and will then remain luminous if suddenly plunged into water.

At a recent meeting of the Zoological Society of London,, Mr. R. Lydekker read a paper on "The Pleistocene Birds of Sardinia and Corsica.

The "Nuovo Giornale Botanico" for October contains a paper by Sig. Martelli, in which he discusses the effects of a vine-disease which has appeared in the vicinity of Florence, and which he considers to be analagous to the "black rot" caused by a Pyrenomycetous fungus (*Physalospora Bedwelli*).

The egg plant (Solanum melongena) which is so common in the Grecian Archipelago, has, among the sailors of the Levant the reputation of being the harbinger of foul weather. Its first appearance, they say, is invariably ushered in by a strong gale from the north-east, that lasts several days.

The entire area of the Mediterranean and Black Seas has been estimated at upwards of a million square miles, and the volume of the rivers which are discharged into them at 226 cubic miles. All this, and much more is evaporated annually.

It is a well known fact that birds enjoy much longer terms of life than do mammals. Hesiod and Pliny, both tell us of rooks that lived to the patriarchal age of 700 years, and that the average life of a raven was 240 years. How far this was correct we cannot determine. It, however, well known that they outlive man; while swans have been known to live 200 years, chaffinches, and nightingales have been kept in confinement for 40 years. Girardin tells us that he had a heron for 52 years, and that he knew of two storks that built their nests in the same place for forty years.

The distance at which the horizon is situated from an observer may be readily ascertained provided that the exact height of the observer's eye above sea level be known. Thus at sea, if the eye be five feet above the sea-level, the distance of the horizon will be three miles: if sixty feet, ten miles.

Through the Straits of Gibraltar, two currents are constantly flowing, the one being superimposed on the other. The upper and more copious one flows in from the Atlantic at a rate of nearly three miles an hour, or 140,000 cubic metres per second, and supplies the difference between the rainfall and evaporation, while an undercurrent of warmer water, which has undergone concentration by evaporation, is continually flowing out at about half the above rate of movement, getting rid of the excess of salinity, even thus, however, leaving the Mediterranean salter than any other part of the ocean except the Red Sea. In the eastern portion a similar phenomenon occurs, when the fresher waters of the Black sea flow as a surface current through the Dardanelles, and the salter water of the Mediterranean pour in below it.

In the "Independance Belge," M. Hectot Chainage contributed an interesting article concerning the fossil iguanodons that were discovered in the Bernisart Colliery in Belguim in 1879. The creatures were of immense size and in general appearance they somewhat resembled the kangaroo; but they were much bigger. The Belgium government undertook the expense of the excavation, and 100 tons of bones occupying in all 22 railway waggons were sent to Brussels. Elaborate precautions were taken to preserve the remains from the atmosphere, as having been so long buried in the alluvium in which they were found, there was a danger of them falling to pieces. They were, accordingly, all coated with plaster and wrapped in cloth, after which they were dipped in gelatine, and the skeletons of the creatures were rebuilt from them. These processes have occupied 12 years. Five skeletons have now been completed; and they may be seen in the Museum at Brussels.

The juice of the lacquer-tree (*Rhus vernicifera*) is the natural varnish upon which depends the famous lacquer work of the Japanese. Specimens of the tree were brought from Japan 16 years ago and planted in the Botanical Garden at Frankfort, where they have flourished and have yielded seeds from which thrifty young trees have sprung. This place now has 34 healthy trees 30 feet high and 2 feet in circumference near the ground. To determine whether the juice is affected by its changed conditions, Prof. Rein has sent samples to Japanese artists for trial, and is having comparative analyses made by eminent chemists. If the reports are favourable, it is expected that the lacquer-tree will be quite extensively planted in Germany, and that Europeans will be instructed in the art of lacquering wood by some skilled worker from Japan.

In Symond's Monthly Meteorological Magazine for October last, it is noted that the most cloudy station in the British Empire is Hobart in Tasmania, and that the least cloudy place is Malta.

Editor. J. H. Cooke. B.Sc., F.G.S., Malta.

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Remarks upon the Relationship of the Molluscan Fauna of the Red Sea and Mediterranean.

Edgar A. Smith, F.Z.S.

The subject of the relationship of the Faunas of the Mediterranean and Red Seas is most attractive, and has been more or less fully discussed by R. A. Philippi, Paul Fischer, R. MacAndrew, A. Issel, and A. H. Cooke.

Certain species have been regarded by some of these authors as common to the two seas, and it has been conjectured by them that an intermingling of the faunas of these seas has occurred in past ages when a junction of their waters apparently existed. Species which are commonly regarded as Mediterranean, and which occur in the Gulf of Suez, are supposed to have gradually migrated southward, and, when the two seas became separated, to have established themselves as permanent inhabitants of the warmer waters.

Now, after a careful study of the geographical distribution of these species, finding that all exist also far east in the Indian Ocean, having a much greater range in this direction than through the Mediterranean and some distance into the Atlantic, and considering the Indo-Pacific character of the Red-Sea fauna, it seems to me equally or more reasonable to suppose that the Mediterranean specimens were derived from a Red-Sea source than *vice versâ*. It may be urged in opposition to this theory, how is it that such and such species have been found at Suez only, and at no other part of the Red-Sea? The answer to this is simply, that the shores of the Red Sea have only been cursorily examined in a few places, and I fully anticipate that, whenever other more southern parts have been as well investigated as the Gulf of Suez, most of these species will be met with. Already two out of the eight have been recorded as far south as Assab,

Geographical distribution of species is such an enigma in many cases that one feels reluctance in launching forth any theory whatever. Some species, at far as our present knowledge of them extends, appear to have an almost unlimited range; whilst, on the contrary, other allied forms seem to be equally restricted. As examples, I may instance *Arca lactea* and *A. olivacea*. The former little species ranges through the Mediterranean into the Atlantic as far north as this country, southward along the West of Africa past the Atlantic Islands to Ascension Island, on to the Cape of Good Hope and Natal, and finally it is known from the Red Sea and Philippine Islands. The other species, *A. olivacea*, the distribution of which, as far as we know, is as limited as that of *A. lactea* is extensive, has at present only been recorded from the Philippines. I could multiply cases of this kind, but the one mentioned is sufficient to demonstrate the unaccountable difference in the distribution of allied forms. There seems to be an unfathomable something in their nature which permits the one to live under very varied conditions, in temperatures greatly differing, and in waters of which the chemical composition is dissimilar, and on the other hand which does not allow the other to exist excepting under special and limited conditions. It is so in the vegetable kingdom. Do we not find some plants which will grow almost anywhere, in all kinds of soil, whereas to others existence appears to be possible only amid very special surroundings? Being cognisant of such facts as these, it is with much diffidence that I have suggested the migration, so to speak, of the species in question, or some of them at least, from the Red Sea into the Mediterranean. However, taking all points into consideration, I think this supposition is likely to be as correct as the view usually entertained.

Some support to this theory is derived from a study of the emigration of species from the Red Sea to the Mediterranean and *vice versâ* since the opening of the Suez Canal. From the reports upon the subject by Fuchs (1), Keller (2), Krukenberg (1), and others, it is evident that there is a greater pilgrimage taking place northward than towards the south, and this, to some extent, is possibly attributable to the movement of the current from the Red Sea to the Bitter Lakes being faster than that from the Mediterranean southward, for there is a flow in both directions, owing to the great evaporation in the Bitter Lakes. At present two Red Sea forms *Mytilus variabilis* and *Mactra olorina*, have been taken living at or near Port Said; on the contrary, no Mediterranean species has as yet got through to Suez, but *Cardium edule* (if correctly identified) is said to have almost reached there. Although certain species may extend northward and to the south, it yet remains to be seen if they become modified to any extent, supposing the altered temperature and chemical composition of the water into which they may have migrated permit their race to be perpetuated.

I can well imagine that eventually it will be found that all the rest of the species have as wide and very nearly the same distribution as *Arca lactea*, and therefore the possibility is suggested that their presence in the Mediterranean may have originated from the Atlantic end and not from the eastern or Red Sea extremity. Suggestive of this is the fact that specimens of the same species from the Atlantic Islands (Madeira, Canaries &c.) and the Mediterranaan are absolutely identical, whereas, in some instances at all events, in the Red Sea equivalents some slight modifications are noticeable.

The following table also lends some support to this proposition. It will be noticed that, starting from Australia (2) and the Philippine Islands, all are found in the Red Sea, four at the Cape, one has been recorded from St. Helena, one from Ascension, six from the Atlantic Islands, and all in the Mediterranean.

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(1) Die geologische Beschaffenheit der Landenge von Suez. Wien, 1877.

(2) Neue Denkschrift. allgem. Sceweiz. Gesellsch. 1883, vol. xxviii. pt. 3.

(1) Vergl-physiolog. Studien, 1888, 2nd ser., 5th part, 1st half.

(2) Euthria cornea *was recorded from New Caledonia by Brazier in 1889, and the 'Challenger' dredged off Sydney about 10 species of Mollusca which are inseparable from N. Atlantic forms.*

Name of Species.	Australian region.	Philippines.	Red Sea.	S. Africa.	St. Helena.	Ascension.	Atlantic Is.	Mediterranean.
Chiton siculus	*	...	*	...	...	...	...	*
„ *discrepans*	*	...	*	...	...	...	...	*
Philine operta	*	...	*	*	...	...	*	*
Lima inflata	...	*	*	*	...	...	*	*
Arca lactea	...	*	*	*	...	*	*	*
Venerupis irus	...	*	*	...	...	...	*	*
Petricola lithophaga ..	...	*	*	*	...	...	*	*
Gastrochæna dubia....	...	*	*	...	*	...	*	*

It is quite possible that most of these species may have been carried across the Indian Ocean (1) to the Cape in various states of development, for we know that a very large quantity of pumice thrown into the sea during the eruption of Krakatoa in 1883 was drifted in that direction, indicating the course likely to be taken by larval and pelagic forms or even by adult organisms (like the last five of the above species) if attached by a byssus to, or burrowing into, floating substances like pumice. Passing the Cape they may have extended up the West-African side of the Atlantic past the Atlantic Islands (2), and so on into the Mediterranean, at the entrance of which at Gibraltar, the main strong *surface* current is from the Atlantic eastward, which would of course be favourable to the influx of species from that sea.

As I have before stated, this is all mere conjecture, and we have to assume a starting-point somewhere in the East, for which we have no grounds. The proposition that species common to the Red Sea and the Mediterranean may have originated in the East, holds good also in regard to three of the four species which I consider sufficiently different from the Mediterranean species to be regarded as distinct. Even if we consider them practically identical, as Mr. Cooke does, we find that they have as near representatives in the Indo-Pacific. In the case of the fourth species, *Tellina isseli*, I am not aware that it has been found anywhere except in the Gulf of Suez, a fact which to some extent confirms its distinctness from the Mediterranean *T. balaustina*, considering that all the other species common to the two seas have an enormous distribution.

In the foregoing observations no reference has been made to the light which Palæontology may throw upon the subject of distribution of the species in question. It is true that most of them are found fossil in the Miocene, Pliocene, and other Tertiary rocks of Italy, Sicily, &c., a fact which would seem to indicate a long establishment in the northern hemisphere. On the other hand, a number of recent Mediterranean and Atlantic forms have already been recorded from the Tertiary deposits of Australia (1); and we may therefore conjecture that when the Palæontology of Australia and other eastern countries has been more fully worked out, many more so-called European species will be discovered. Such being the case, I fail to perceive that the evidence afforded by Palæontology lends more support to any one of the theories of distribution set forth than to another. Probably all are wrong.

Proc. Zoo. Soc. London.

(1) *We conjecture that the ocean-currents took the same direction in bygone days: what grounds have we for this?*

(2) Vide *my reports on the Mollusca of St. Helena and Ascension Island (P. Z. S. 1890, pp. 247, 317).*

The Geological Photographs Committee of the British Association and its Work.

From the copy of the second report of the above Committee which the secretary Mr. O. W. Jeffs has favoured us with, we note that no efforts have been spared to render the work of this important branch of the British Association of the highest scientific value. Since last year the scope of the operations of the Committee has been considerably extended and many societies have been induced to enter with spirit into the scheme. The object that the Committee has in view is, "to arrange for the collection, preservation, and systematic registration of photographs of geological interest in the United Kinghdom:" and judging from the lists that are appended to the report there can be no doubt but that the work that is being done will prove itself to be of incalculable benefit both to

(1) *R. Etheridge, jun., Cat. Australian Fossils, 1878.*

the present generation of geologists and to future ones. The example that the British Association has set is such as might be advantageously followed by the leading geological societies of the continent. If an International Committee were formed, and sub-committes were appointed for the purpose of carrying out a similar scheme in Europe, there would be no lack of workers forthcoming to further the object in view; and the results in so far as they relate to geological science, would be invaluable.

Notes on Ant's-nest beetles at Gibraltar and Tangier; with especial reference to the HISTERIDÆ.

BY J. J. WALKER, R.N., F.E.S.

Among the numerous species of *Coleoptera*—about 1800, at a moderate estimate—which were collected by me on both sides of the Straits during my recent stay of two years and a half at Gibraltar in H.M.S. "Grappler," the *Myrmecophila* were, I think, my chief favourites. I was stimulated to give special attention to them first, by the discovery at Tangier, in March, 1887, of a very fine and distinct species of *Sternocœlis*, which has since been described by Mr. Geo. Lewis under the name of *S. acutangulus* (Ent. Mo. Mag., vol. xxiv, p. 164), and subsequently by the wonderful series of ant's-nest *Histers* captured by that gentleman in the same locality in the spring of 1888, which he was kind enough to show me when passing through Gibraltar. The lucid and admirable paper "On the capture of Formicarious Histeridæ" since published by him ("Entomologist," vol. xxi, p. 289, *et seq.*) almost exhausts the subject of the habits of these marvellous little beetles, and the following notes, as far as the *Histeridæ* are concerned, must be regarded as mainly supplementary to that paper.

Of the four species of Myrmecophilous *Histeridæ* which came under my notice, all were found exclusively with ants of the genus *Aphænogaster*, living under stones, and almost entirely with one species, viz., the black, pubescent *A. testaceo-pilosa*, Lucas. Curiously enough, however, the very first "ant's-nest *Hister*" I ever saw alive—the original specimen of *Sternocœlis acutanguls*, Lewis—occurred at Tangier in a small nest of the bright red *A. sarboa*, Mayr, and on one subsequent occasion only, I found both *S. acutangulus* and *Eretmotus tangerianus*, Mars., with the same ant. The commonest species appears to be *S. arachnoides*, Fairm., which is by no means rare near Tangier, though I did not meet with it in such numbers as did Mr. Lewis: this species occurred only on the African side of the Straits, while the little *S. fusculus*, Schmidt, was only found very rarely near Gibraltar, being apparently represented at Tangier by the allied *S. mauritanicus*, Lewis, a species I did not obtain. *Sternocœlis acutangulus* and *Eretmotus tangerianus* occur both at Tangier and Gibraltar.

Although *Aphænogaster testaceo-pilosa* is a generally distributed and very abundant ant throughout the district, according to my experience it was of no use searching its nest for *Coleoptera* of any kind, except on the stiffest clay soil, which, near Gibraltar, is limited to two small spots—one at the western foot of the Sierra Carbonera, near the village of Campamento, and within easy walking distance of the Rock, the other near the Sierra Lorca, some three miles beyond San Roque. Another very good-looking place, which I was unfortunately able to visit on but few occasions, is the low undulating country behind Algeçiras, where, on March 16th of this year, I found seven specimens of *S. acutangulus* in one small nest. At Tangier the clay soil is more predominant, especially near the massive ruins of Tingis or "Old Tangier," three miles east of the present town, which locality was kindly indicated to me by Mr. Lewis. A large amount of moisture is necessary to a successful search, as in fine dry weather any number of nests might be examined without finding a single *Hister* in them, while a sunny afternoon, after recent rain, was sure to produce one or more specimens. The greatest haul I ever made in one day was at Tangier, on December 20th, 1888—a day of cold wind and almost incessant driving rain—when I took twenty-four specimens of ant's-nest *Histers*, including nine *Eretmotus tangerianus*.

The presence of larvæ or pupæ in the nests is also essential to that of the *Histers*, and a

the ants disappear from under the stones when the hot weather sets in, and retire to cooler places, it is useless to look for their attendant *Coleoptera* between May and October. I have, it is true, found thriving nests of *Aphænogaster testaceo-pilosa*, full of "brood" as early as October 27th, but have not met with any *Histers* before November 17th: the latest date on which they have occurred to me is May 14th, when I found one or two *S. arachnoides* with very mature pupæ of the ant; the soil (at Tangier) being then baked almost as hard as a brick by the sun. February and March appear to be the months in which they may be looked for with the greatest prospect of success.

The search for ant's-nest *Hister* entails no small amount of patience and exertion, as I do not think that more than two or three per cent. of the ant's-nest contain them, and the stones (which it is as well invariably to turn as gently as possible, and to carefully replace after investigation) are often of great size and weight. Still, it is a pretty sight, and one which compensates for a great deal of strain to the eyes, as well as to the back, to see a *Sternocœlis* or *Eretmotus* lying motionless among the hurrying crowd of ants, and then suddenly developing an amount of leg quite surprising in so small a creature, marching off daintily on the tips of its toes (or rather tarsi) with a ludicrous resemblance, in its gait and appearance, to a tiny crab. As Mr. Lewis suggests (*l. c.*, p. 291) the ants appear to regard these intruders with a certain amount of philosophic indifference, as "an evil which they are unable to divert:" their comparatively weak mandibles being ineffective against the hard armour and tightly packed limbs of the beetles, which devour the helpless brood with impunity. I have more than once taken *S. acutangulus* with a half-eaten larva in its jaws, and they are usually to be found clinging to the masses of larvæ where these lie thickest. On the other hand, I once (but once only) saw an ant take up a *S. arachnoides* in its mandibles and carry it off into a lower gallery of the nest, but this may have been done under the influence of alarm, the frightened ant seizing on the first object that came in its way.

I have never found the *Histers* in any of their preparatory stages, but having occasionally come across somewhat immature specimens of *S. acutangulus* in the ant's-nest, I am inclined to the idea that the larvæ, like the perfect insects, will eventually be found there. The beetles usually occur singly, or at most two or three in one nest, but, occasionally, several species are found together. Thus, on December 28th 1888, I found, in a not very populous colony of ants, three *S. acutangulus*, one *S. arachnoides*, and four *Eretmotus tangerianus*—in all eight specimens. I have also taken half a dozen *S. arachnoides* from a single nest, this species being apparently (as Mr. Lewis has also observed) more gregarious in its habits than the others.

(To be continued.)

The Latest Theory of Volcanoes

Through the courtesy of Mr. O. W. Jeffs the Secretary of the Geological Photographs Committee of the British Association we are enabled to give our readers the following details of a paper entitled "The Volcanoes of Southern Italy: with a note on the latest theory of Volcanic Action," which he read before the Chester Society of Natural Science.

The first part of the paper was chiefly occupied by a description of a series of photographs illustrating the craters and lava streams of Vesuvius, Stromboli, Etna, and Vulcano. These views were taken last year (shortly before the recent eruption of Vulcano) by Dr. Tempest Anderson, of York, and were shown by him at the British Association at Bath last September. Amongst these were instantaneous pictures of the craters of Vesuvius and Vucano during eruption, that showed very vividly the discharge of steam and showering of ash which usually takes place. The ruined temple of Serapis, with its columns, made famous by the observations of Sir Charles Lyell, and described in his classical work, "The Principles of Geology," was also shown. After conducting his audience through an imaginary town in Southern Italy, and the less known region of the Lipari Islands, Mr. Jeffs devoted the remainder of his paper to a brief discussion on the main elements of volcanic action

which were regarded as twofold: The existence of a high temperature at certain points within the earths crust, and the presence of quantities of water and gas imprisoned in the rocks. Proofs of the former were to be seen in the molten condition of the matter issuing from volcanoes, and of the latter in the vast quantities of steam and gases thrown out during an eruption. The condition of the earth's interior has long been a problem. Man has always felt a desire to know what was in the earth, and volcanoes were one means of gaining an insight into the hidden regions below the surface of the globe. The old idea, so long held, that we are dwelling upon a thin stratum, or crust, covering an enormous well of molten matter, was hardly supported by recent researches of geologists and physicists. The idea is gradually gaining ground that volcanic action is not due to the existence of a universal resevoir of incandescent matter, but to the local development of heat at moderate depths from the surface and in parts of the crust independent from one another. Mr. Mellard Reade has lately given to the world one of those original and striking theories with which the most progressive of the physical sciences is enriched from time to time. In his "Origin of Mountain Ranges," Mr. Reade has called attention to the intimate connection existing between volcanic action and mountain-building. All mountain ranges have once been areas of sedimentation, and in all ranges volcanic orifices have been broken through old denuded rocks. According to his theory the deep-seated rocks are regarded as practically solid, through pressure, although hot; but this material, if at the surface, where the pressure would be less, would assume a form nearly liquid or flowing, a condition known as "potentially-molten." The rocks become heated by continued deposits over them, water is imprisoned in them, and steam is generated. which is the sole essential phenomenon of volcanoes. The expansion of the rocks causes the production of fissures, through which water penetrates, and an explosion ensues. The welling-out of lava in a molten state is caused by the expanded matter finding a relief through suitable vents or lines of weakness in the crust of the earth. Mr. Logan Lobley has recently arrived at a similar conclusion. Hitherto the *cubical* expansion of rocks under a rise of isogeotherms has been overlooked, until pointed out by Mr. Reade. The movement of rock masses caused by this expansion results in the phenomena which are found to accompany the formation of great mountain ranges and the eruption of volcanic matter in all parts of the globe. The chemical theory as ably advocated by Professor Prestwich need not be altogether discarded, but the effects of this action were regarded as of secondary consequence. Mr. Jeffs, in conclusion, maintained that many physical causes operated in producing volcanic action. The relation between one set of volcanic phenomena and another, and the origin of those great movements which have been recorded throughout all the geologic ages, have long been mysteries requiring the most devoted study of the physics of the earth's crust to afford us even a glimpse of their solution.

CYPRUS,

by Lieut.-General Sir R. BIDDULPH, G.C.M.G., C.B., late H. M. High Commissioner, Cyprus.

(concluded.)

After Nicosia fell, Famagusta still held for many months. It was the last stronghold of the Venetians, and its gallant defence by the Venetian governor, Bragadino, is a matter of history. For eleven months he withstood the constant attacks of the Turks, and at last, worn out by losses and famine, he surrendered. The Turks, destitute of all sense of chivalry towards a brave enemy, revenged themselves for the losses they had experienced by flaying him alive. His skin was ultimately given up to the Venetians, and was deposited in an urn which was placed in one of the churches in Venice, where it is still to be seen.

Famagusta was fortified like Nicosia, and was jealously guarded by the Turks. The walls were kept in good order, and the Venetian guns remained on the ramparts. Near the water-gate, in a casemated room, were found heaps of decayed and rusty armour, which evidently had been thrown there after the capture of the city, and had remained there ever since. But though the walls of Famagusta are in good repair, the city within is in ruins. Never was there such a city of ruins; in the midst appear open spaces of ground, some even being ploughed and sown. About 800 persons, all

Turks, live within the walls. A new town, called Varoshia, has sprung up half a mile outside the gates, where all the business is carried on. The old cathedral of Famagusta is a very striking building, terribly ruined, but still used as a mosquè, like the old cathedral of Nicosia, to which I have alluded.

The only other fortress of any consequence was the fort of Kyrenia, a mediæval-looking castle picturesquely situated at the water's edge, and occupying one side of the small harbour of Kyrenia. It is now used as a prison.

Three ruined castles, dating from the times of that Crusades, are situated on the northern range hills. The most important of these is the Castle of St. Hilarion, situated about half a mile to the west of the Kyrenia Pass, and 2380 feet above the sea. Parts of it are in a fair state of preservation, and from the extent of its walls it must have required a garrison of at least 500 men. It was besieged and taken by Richard Cœur de Lion when he landed in Cyprus on his way to Palestine. It is easily approached from the east, but on other sides it is inaccessible.

The ruins of another castle are found on the top of Buffa Vento, which is nearly the highest peak on the northern range, and about halfway between Pentedaktylon and the Kyrenia Pass. Very little remains of this ruin, and the most perfect portion, containing a fine Gothic window, was much damaged by an earthquake five or six years ago. The castle is most difficult of access, and its building must have been a work of great labour. It can now only be approached by climbing from the foot of the hills.

The third ruined castle on the northern range is Kantara, situated in the Carpas at an altitude of over 2000 feet. It is in a better state of preservation than the castle of Buffa Vento, though not so good as St. Hilarion. It is called by the Greeks "Ekatonspitia" (hundred houses). From the castle of Kantara, looking westward along the northern shore, is one of the most beautiful views in the whole island.

There is another beautiful ruin in the northern range, viz. the old monastery of Bellapais, about three miles from Kyrenia. The refectory is still in good repair, and the rest of the building, though roofless, shows distinctly the monks dormitories, the chapter room, cloisters, &c. The chapel of the monastery is still used as the village church. The tracery of the windows and cloisters is very perfect in many places.

These ruins all date back from the middle ages, mostly from the time of the Lusignan dynasty. Of ancient buildings of an earlier date there are but few remaining. Probably the oldest complete building is the church of the Holy Cross, on the top of the mountain of Santa Croce, which is stated by the Mas Latrie to have been founded in the fourth century. The lower part of the walls is evidently a far more ancient heathen temple.

There are other places, mostly in ruins, of little architectural interest, but interesting by their traditions, such as the tomb of St. Barnabas (concerning which there is a curious tradition), the old Tower of Kolossi, near Limassol, and ancient cities and temples, whose ruins yield old statues, of no very striking merit, to the antiquity hunter.

Extensive ruins, three miles north of Famagusta, indicate the site of Salamis, once a most flourishing seaport, the place where St. Paul landed when he visited Cyprus. It evidently was a wealthy place, and ruined columns, still remaining, show that an aqueduct conveyed water to the city from the spring at Kythrea, a distance of 25 miles as the crow flies. At Larnaca is the site of the ancient port and citadel of Kitium (or Chittim). A hill called Bamboolah marks the site of the latter, and yields to the excavator large blocks of finely cut stone.

There are two ancient independent monasteries, both situated on the southern range, viz. Kikko, which stands on the watershed of the Troondos range at an altitude of 3800 feet, and Machera, which is further east and is most picturesquely situated on the northern slopes of the southern range. Kikko was founded 800 years ago, but the old building was destroyed by fire in 1817, and then lost all its books and MSS. It is very wealthy, being a shrine of some sanctity, and receiving many pilgrims every year. It possesses property, not only in Cyprus, but also in parts of Turkey, both in Europe and Asia, and considerable property in Tiflis.

Machera is not so large or wealthy as Kikko, but it is in some respects a more interesting spot, Amongst other objects of interest, it possesses a picture of a former abbot, who subsequently became archbishop of Cyprus, and was hanged by the

Turks with the other bishops in 1823. If we may trust to tradition, he was probably the ablest man who ever occupied the archipiscopal see. The portrait is a striking one, and was executed, I think, in Wallachia, where he had been sent on a mission when only a young member of the monastery of Machera.

If time did not fail me, I should like to prolong this subject, and to take you with me in imagination to some of the beautiful spots which are to be found in Cyprus, to enter the houses and see the towns people at their avocations, the women weaving silk at the primitive looms, of which specimens were shown in the Colonial Exhibition three years ago; to visit the villages; to listen to the shepherds piping to their flocks; to follow the mountain tracks, where amidst the murmuring of the streams, by the side of a hazel copse, or under a shady old walnut tree, you might listen to the cawing of of the crows and imagine yourself in England. But there is something besides time that fails me, and that is the capacity to do justice to the infinite variety of scenery which Cyprus affords, to depict adequately the charm of travelling through every part of the island, pitching one's tent in every variety of spot; now on a village green; now on a mountain side; one day in the depths of the silent forests; another day by a babbling stream under the shade of magnificent palm-trees; or again seeking shelter from the sun in the old refectory of the monks of Bella Pais.

If my failure to depict such scenes would induce any of you to go and visit them for yourselves, you would be amply repaid. Tho exhilarating air imparts a peculiar charm to the scenery, which is heightened by the simplicity and hospitality of the villagers. To be in a country so near to civilization, and yet where news from the outside world arrives only once a fortnight, and where there are no railways! Such is the place to refresh the mind wearied with daily papers, telegrams, sensational news, and advertisements, with the postman coming ten times a day with letters which you don't want to get.

It is a remarkable fact that most of those who have been resident in Cyprus want to go back to it again. For my own part there is no country which I would so gladly revisit for a holiday, and I can therefore conscientiously recommend it to those who wish to escape from England during the trying months of January to April in this country.

The Samos fossil Mammals.

The labours of Prof. C. J. Forsyth Major in the Tertiary beds of Samos, a small island in the Turkish Archipelago, lying opposite the town of Ephesus, were repaid by the discovery of a most unique series of fossil remains of mammals.

The collection, which was the result of his three years work, was lately purchased by the trustees of the British Museum, and it has been deposited by them in the South Kensington Natural History Department.

In an account of these remains that was sent to *Nature* a correspondent gives a most detailed description both of the remains and of the deposits in which they were found to occur. He tells us "that the deposit appears to be absolutely full of the bones of mammals; and in this respect it agrees with the contemporary deposits of the celebrated Pikermi ravine near Athens, the wonderful mammalian fauna of which has been fully made known to us by the labours and writings of Prof: Albert Gaudry, of the Paris Museum, and other paleontologists".

He then proceeds, to say that the deposits at Samos have, one great advantage over those of Pikermi. Thus, in the latter locality the rock in which the bones are embedded is stained of a brownish-red colour, and very frequently adheres so closely to the bones that they cannot be properly cleaned from matrix; whereas in the case of Samos the rock is of a buffish-white, and can be completely removed from the specimens. This whitish colour of the Samos bones renders them peculiarly attractive objects in a museum; and the contrast between the white bones and the palebrown of the enamel of the teeth in the magnificent series of skulls now displayed in the Museum is very striking. So well preserved, indeed, are these specimens that many of the skulls are almost as well suited for precise anatomical comparison as those of existing species.

The number of specimens from these deposits acquired by the Museum is no less than 533;

the whole of these, with the exception of one bone of a bird, belonging to mammals. As another collection of at least equal extent has been acquired by the Museum at Geneva, the importance of this newly discovered fossil fauna may be readily estimated.

The discovery of this ossiferous deposit, taken in conjunction with that of the equivalent beds at Maragha, in Persia, which were brought to the notice of scientific world only a few years ago, indicates that there is still hope of much further knowledge of the Tertiary mammalian fauna being eventually obtained by the full exploration of regions lying beyond the European area. As we have already mentioned, the Samos deposits are the equivalents in point of time with those of Pikermi in Attica, and of Maragha in Persia; this identification resting upon the general similarity of the fauna of the three areas, although each locality has some peculiar types not known in the others. The researches of Mr. W. T. Blanford and others have shown that we must assign a Pliocene age to the deposits at Pikermi. And with our present knowledge, the Pikermi fauna may now be traced from Baltavar in Hungary, though Greece, thence to Samos, Persia, Baluchistan, the Punjab, and so to the Siwalik Hills of Northern India, the mammalian fauna of which was the first to be brought to light though the classic labours of Falconer and Cautley. From this fauna, which forms a belt in the regions surrounding the whole of the north-eastern frontier of Africa, it is now pretty certain that the modern mammalian fauna of that continent was derived; and it is noteworthy that the fauna of Samos, and still more that of the Siwalik, contains the greater number of forms most closely allied to those of Africa. In Pikermi and Samos no true elephants occur, but in the Siwalik elephants more or less closely allied to the existing African and Indian species are abundantly represented.

Among the mammals discovered at Samos, a large number are identical with those occurring at Pikermi. Thus, the well-known three-toed horse *(Hipparion)* is especially common in both localities. The rhinoceroses and mastodons likewise appear to have been, in most cases at least, specifically the same. Again, many of the antelopes found at Pikermi, some of which are allied to the African oryx and others to the koodoo, reappear at Samos. A large ruminant from Samos, as yet undescribed, but to which the provisional name *Criotherium* has been applied, appears, however, to be an antelope totally unlike any existing form. In this remarkable animal the horns are set on the extreme vertex of the skull, as in the hartebeest, the gnu, and the ox, but are extremely short, tightly twisted, and bent right in front of the forehead, in a manner totally unlike that found in any existing antelope.

Skull of a Samotherium.

Perhaps, however, the most remarkable of the new mammals discovered at Samos is the large ruminant for which the name *Samotherium* has been proposed. Of the skull of this creature we are enabled, by the courtesy of Dr. Woodward, to give a figure. It will be seen from this figure that the general proportions and contour of the skull are very similar to those of the giraffe; and the molar teeth are practically indistinguishable from those of the latter. The remarkable feature of this skull is, however, the presence of a pair of upright horn-cores, situated immediately over the eyes, and inseparably connected with the frontal bones, of which indeed as in the antelopes, they form mere projections. This condition is very different from that ob-

taining in the giraffe, in which, it need hardly be said, the so-called horns are short bony processes, covered with skin in the living condition, and entirely distinct from the frontal bones. The horn-core of the samothere are, indeed, very similar to those of certain Pikermi antelopes, and were, in all probability, sheathed in horn in the living animal. This ruminant appears, therefore, to indicate a close genetic connection between the giraffes and the antelopes; and since the giraffe itself is very closely allied to the deer, while the extinct Indian sivathere exhibits many points of affinity with the giraffe, but appears to have had deer-like antlers which were never shed, we see how little importance can really be attached to horns and antlers as indicative of want of affinity, or the reverse, between their respective owners. Indeed, there can now be but little doubt that deer, giraffes, prongbucks, and antelopes, are all descended from a common stock; the intermediate and annectant types having mostly died out, althought the evidence of their former existence is now slowly but surely accumulating.

The only other mammals calling for especial notice are a species of aard-vark *(Orycteropus)* and a pangolin.

Occurrence of "Chrysophrys" in the Malta Miocene.

The occurrence of the remains of the fish Chrysophrys in the Maltese Miocene has not hitherto been recorded, it will therefore be of interest to Maltese geologists to learn that I have found the teeth of this fish in the Marl, in the Globigerina Limestone, and in the Greensands.

Professor Capellini very kindly determined the specimen from the Marl bed.

J. H. C.

Observations on the Geology of the Maltese Islands

BY

JOHN H. COOKE.

(continued from No. 5.)

Taking up our position, therefore, on one of the Binjemma heights in the vicinity of Gebel Ciantar or Ghain Toffiha, and gazing down from our coign of vantage upon the wide expanse of mountainous, forestclad country around, a scene of varied and picturesque beauty confronts us. Hill and dale, mountain and valley, lake and rivulet form one vast panorama that extends as far as the eye can reach.

The tinkling music of purling streams, whose waters appear, in the bright sunshine, as silvery threads entwined among the dark, green foliage of the palms, ferns, swamp cypresses, laurels, mimosas, oaks, myrtles, and acacias that clothe the slopes, attracts our attention, and causes the eye to involuntary follow the courses that the streams pursue as they meander onward to the broad and noble river, that winds along the bases of the hills to the southward.

Let us saunter through the forests of club-mosses, ferns, and palm-trees that cover the hill sides around us; and let us observe, more closely, the animal life with which these wilds are tenanted.

The air is alive with the twittering and screams of feathered songsters, that are carolling forth their melodious music from the branches of the trees around. Soft balmy breezes lightly kiss the foliage, and cause it to respond in murmuring whispers to their advances. Swarms of midges, dragonflies, and other flies (Syrphus) rise from the green sward and mosses, and with drowsy hum dart upward, coquetting with the sunbeams that here and there pierce the moving canopy of leaves and branches, and exhibiting in a never ending variety the brilliant colouring of their wings, and the matchless symetry of their proportions. A monster swan, *Cygnus falconeri*, (1) that was a few moments since, foraging in the rank verdure of the morasses that fringe the river's bank, has now taken flight, and is rapidly moving towards the flocks of its companious (*Cygnus Melitensis* and *C. Alor*) (2) whose snowy white forms we see in the distance glancing in the sunshine as they hurry onward with swift and noisy motion towards the calm, glassy waters of the lake that lies to the eastwards.

And on the most prominent of the many pinnacles that fringe the ravine stands in majestic and watchful solitude, a magnificent vulture

(1) Falconer Dr. Paleontological Memoirs Vol. II. 300. 305. 307.

(2) Parker. Trans. Zoolog. Soc. Vol. VI. 119.

Gyps melitensis (1) whose size exceeds by one fifth that of the well-known *Vultur monachus*, and which is therefore the largest accipiter known except *Harpagornis*.

It is watching with greedy eyes the group of cranes, *Grus melitensis*, who are hastening towards the borders of the lake in search of their morning meal.

The air teems with life
"The insect youth are on the wing,
Eager to taste the honied Spring,
And float amid the liquid noon;
Some lightly o'er the current skim,
Some show their gaily, gilded trim,
Quick glaring to the sun."

And there, daintily skipping in fearsome haste from bough to bough, is a sleek, soft-eyed little creature, which, in appearance strongly resembles the dormouse that now infests our cornfields, but which, in size and habits, is more nearly allied to the squirrel species.

It is a squirrel-like mouse *Myoxus melitensis*, that has been enjoying a hasty repast amid the profusion of wild fruits with which the surrounding woods abound.

And as we proceed onward, we find that the jungle thickens, and trees of a larger and stronger growth, among which the oak and the acacias are specially predominant, take the place of the more fragile and delicate vegetation that crowns the summits of the hills.

Have a care, for these wilds are tenanted by creatures that recognise but one law, that of might; and woe betide those that are unable to hold their own against them.

See yonder group of snorting, dusky leviathans, that are now rounding the base of the neighbouring hill. The huge beasts *Elephas Mnadrae*, belong to a species of elephants at least equal, if not greater, in point of size, than those that are now found in the northern provinces of India. We will allow them to pass; and then we will wander down to their feeding ground.

Passing through a glade, that is carpeted with a waving pile of the most delicate green, and which is redolent with the perfume of the blossoms of the buckthorn, and the dogwood, we emerge into the open, and find ourselves in the vicinity of the place lately occupied by the herd.

The delicate fronds of the ferns lay bruised and broken around us; and, intermixed with the twigs and foliage of the poplar *Populus balsamoides* and *P. mutabilis*, and the beautiful *Podogonoæ*, lay the tender, green filaments of the club mosses, that had been either crushed by the broken branches, or had been trampled out of all semblance to their former-selves by the formidable animals that had just passed over them.

And now emerging from the farther extremity of the glade we see another group. In form and colour the animals differ but little from the leviathans that have just passed; but in size they are by comparison pigmies indeed.

The smallest of them, *Elephas falconeri* barely exceeds in height an average Newfoundland dog; while the others belonging to the species *Elephas Melitensis*, attain a size that is not greater than an average sized donkey. See! they are now busily engaged in breaking off, with their diminutive trunks, the succulent shoots of the trees that their larger and more powerful brethren had borne down in the course of their progress down the hill.

We will leave them to enjoy their repast, and we will wend our way down the slopes towards the lake, whose waters lap the eastern bases of the Binjemmas, and there watch the sportive antics of the shoals of animals that lie basking on its surface, and gambolling on its sedgy banks.

Near the mouths of the numerous affluents, that discharge their waters into the basin, are numbers of hippopotami, some swimming hither and thither, others lying motionless on the calm, still surface of the lake.

With his tough hide, and huge jaws, the Maltese river-horse, *Hippopotami pentlandi*, would methinks prove himself to be a formidable foe to any that would have the hardihood to oppose him.

One of them has now landed, and is dragging his ponderous bulk up the steep banks. May-hap, he is after some dainty morsel wherewith to satisfy the cravings of the enormous appetite, that such a body must possess. His unceremonious advent

(1). *Lydekker. R.*—"*On the remains of some Large Extinct Birds from the Cavern Deposits of Malta. Proc. Zool. Soc. 1890. p. 403.*

among the sedges appears to have aroused several large turtles for yonder are two or three of them slowly making for the water, weighed down by the large osseous carapaces, that stand them in such good stead as a protection from the numerous enemies around them.

And now that we have seen the bright side of Nature in these favoured regions shall we remain to observe it in its darker aspects?

Shall we remain to watch nature in her labour throes; while these land areas are being riven from end to end by the convulsive efforts of the subterranean forces that are constantly accumulating beneath them; and when the three henchmen of Nature, Fire, Air, and Water shall combine to wipe out of existence all traces of the fertility, and abundance that we now see before us.

No! such scenes are not for us. We will retrace our steps and in the quiet and seclusion of the valleys and gorges, in the caverns and on the plains we shall find an abundance of eloquent witnesses of the vissicitudes that the islands have undergone since those remote ages. The cliffs and scaurs still rear aloft their ruin crested summits in all their primæval ruggedness, and the caverns and gorges, from their glooomy, awe inspiring depths still furnish us with mementoes of the creatures that formerly dwelt within their precints.

But the forests have now gone, the rivers and lakes have disappeared, and where once they extended nought now remains but a heaving waste of waters. The Maltese Islands are all that is left of the once extensive area that joined the two great continents; and even they have been so changed that but for the animal remains that have been locked up and sealed within their caves it would have been difficult, if not impossible, to have been able to have demonstrated the intimate relations which we now know the islands formerly bore to the land areas on either side of them. But for these same evidences, the scenes that once made these islands so "fresh and fair" would long since have passed from the mind of man, and have melted away among the misty shadows of antiquity, and so that portion of the chain of events that links Malta past with Malta present would have been irrecoverably lost to us.

And even now we can conceive of a time when, in the never-ending cycle of changes which governs Nature's actions all of these evidences too will be ultimately effaced, and in the memory of future generations the history of the islands's occupation by man, and indeed, its very existence will, like a cloud rapidly drifting out of sight, have sunk behind the horizon of human forgetfulness.

But that stage has not yet been reached.

The caverns and their entombed remains are still left to us; and they serve to bridge over the gulf of time that separates the past from the present. Within the precints of these mausoleums of Nature we find the most incongruous associations: there the bones of the elephant lie peacefully with those of the dormouse, and the remains of the hippopotamus comingle with those of the swan.

The very nature of the physical conditions that endured at the time when these heterogeneos masses of animal remains were thus gathered together, is there photographed in the sands, clays, and breccias that lie so abundantly along the lines of valleys and the coasts of the islands.

But of these I shall have more to say when considering the superficial accumulations of the Quarternary period.

The majority of the ossiferons caves of Malta are to be found in the Oligocene strata, as it is the beds that comprise this series that are the best adapted for withstanding the erosive action of the atmosphere.

Of these the principal are the Gandia Fissure, the Shantin Fissure, the Zebbug Cave, the Malak Cave, the Middle Cave, the Mnadra Gap, the Benhisa Gap, St. Leonard's Fissure, and the Melliha Cave.

The Gandia Fissure is situated in the Lower Coralline Limestone about a quarter of a mile from the village of Micabiba. It was systematically explored by Dr. Leith Adams in the year 1865, (1) and a considerable quantity of elephants bones and molars, remains of dormice, and bones of aquatic birds were found intermixed with the red earth with which the rent was filled.

(1) *Adams A. L. "Nile Valley and Malta". p. p. 165.*

Fossils found in the Candia Fissure.

1. Bones & teeth of dormice, *Myoxus Melitensis.*
2. Bones of aquatic birds, *Cygnus Falconeri.*
3. Remains of *Elephas Antiquus* (1).
4. Remains of *E. Falconeri.*

The Shantin Fissure is a rent which is situated at about a half a mile from the Gandia cave, between the villages of Micabiba and Luca.

Like the Gandia Fissure it was found to be filled with red earth and fragments of limestone, intermixed with which were the molars, tusks, ribs, and vertebræ of several species of elephants.

Among the most noteworthy of the specimens found in this gap was a portion of a tusk, one foot nine inches in length, and seventeen inches in circumference. It is still to be seen in the Valletta museum.

The Zebbug Cave:—In the gorge that lies between the Marsa and the villages of Siggieui and Zebbug there are several caverns in the Globigerina Limestone. It was while examining these in 1859 that Capt Spratt discovered this fissure, the measurements of which are 75 feet long, 5½ feet high, with a width that varies from 2½ feet to a few inches. Dr. Falconer, (2) Mr. Busk and Mr. Parker (3) gave a lengthy description of the fossils that Capt Spratt obtained from this rent among which whese abundant remains of elephants, and birds.

The Middle Cave, the Malak Cave, and the Mnaidra Gap. These three caves, which are situated on the southern coast of Malta, in close proximity to the ruins of Mnaidra, were discovered and excavated by Dr. Adams in 1866. A careful examination of their contents, led to the discovery of an osseous breccia that contained a great abundance of the remains of a gigantic dormouse (*Myoxus Melitensis*) of land birds, (Anseres), and (Cygnus Falconeri) (1). In the Mnaidra cave, the tusks and molars of elephants were also found in great profusion.

(1) *See Falconers memoirs. Vol. 11. pp. 176. 251.*

(2) *Falconer's Pal. Mem. Vol. 11. p. 305.*

(3) *Proc. Geol. Soc. Vol. XXIII. p. 287. op. at W. R. Parket, "Preliminary notes on some fossil birds from the Zebbug Cave. Malta". Trans. Zool. Soc. Vol. VI. p. 119.*

Unlike the deposits in most of the other caves, these were in each case, sealed down by thick layers of stalagmite, beneath which the organic remains were discovered.

Although the caves were well explored, still much remains for the interested observer. Large quantities of the deposit are still *in situ*, from which with a little care the bones and teeth of the ancient animals, of Malta may be easily extracted. About twenty yards to the N. West of the Middle cave there is a talus of bone breccia lying on the slopes, the block of which literally teem with the bones and molars of hippopotami.

The Benhisa Gap: is a small creek, situated at the south eastern extremity of Malta, and is so called on account of its proximity to the tower of the same name.

Adams examined it in 1864 and found it to contain a heterogeneous mass of pebbles intermixed with red earth and elephantine remains, together with the bones of freshwater tortoises (1), of dormice, and of large birds.

Altogether he collected the remains of about two dozen elephants, the greater portion of which were referable to the pigmy elephant *E. Falconeri.*

St. Leonard's Fissure:—This is the only ossiferous care or fissure that has yet been discovered on the northen coast of Malta.

It is situated on the coast a few hundred yards to the north of the village of St. Leonards, and about a mile and a half to the east of Ricasoli. The gap contained a quantity of grey calcareous drift, in which Adams found some molars of the dwarf elephant *Elephas. Falconeri.*

The Melleha Cave:—This cave occurred in the Upper Coralline Limestone, in close proximity to the Church of Melleha. In 1863 Dr. Adams found several teeth and portions of tusks referable to *Hippopotami Pentlandi*, (1) and Capt. Spratt gave an interesting description of the conglomerate that occurs there, and in which similar teeth and bones were afterwards found.

The preceding resume of the work that has been done in the Malta caves is necessarily a brief one. My object will however be accomplished if I

(1). Adams "On some bones of fossil chelonians from Malta" Quart.Journ.Geol.Soc.v.XXII. p. 594.

(1) T. A. B. Spratt. "On the bone caves of Melleha," Quart. Journ. Geol. Soc. XXIII. p. 283.

had said sufficient to encourage others to consult the published memoirs of the authors whom I have mentioned, or if I have aroused sufficient interest in the subject to stimulate them to further investigations in it.

(to be continued).

NOTES AND NEWS.

We desire to call our readers attention to the fact that numbers 1, 2, and 3, of the Mediterranean Naturalist are now out of print. The remainder of the back numbers may still be had.

Recent statistics show that France has 525 learned Societies, of which 135 have been officially recognized as of national importance. Of the total number, 95 are historical and social; 95 agricultural and horticultural; 57 medical and pharmaceutical; 45 scientific; 41 artistic; 37 geographical; and the rest miscellaneous, including photographic, statistical and ballooning associations.

An article on "*Stereodon Melitensis*" by Mr. John H. Cooke, F.G.S., etc., appeared in the current number of the Geological Magazine.

A correspondent writes to know if the little Golden Plover, *Charadrius Virginiacus* is often seen in the Maltese Islands, and if so at what season of the year. Perhaps some of our readers will inform him through our columns.

During the recent expedition of the *Vittor Pisani* extensive collections of animals and plants were brought from the Red Sea and the Ægean Sea by the officers of the Italian Navy.

They are now to be placed at the service of all who are willing to pursue histological and morphological researches, and systematic and faunistic investigations.

The last earthquake of note that took place in Malta occurred in February 1887. It is a remarkable fact that some of the most destructive earthquakes on record, also took place in the same month. The great earthquake of Lisbon in February 1531 during which 30,000 people lost their lives; that of Aquila in Italy, in February 1703, during which 5000 persons were destroyed; the series of earthquake shocks in Southern Italy and Sicily in February 1783 that caused the death of several thousands; the great earthquake in Central America in February 1797 by which 40,000 persons lost their lives in one second of time, and the recent Chilian earthquake in February.

Not the least curious of recent applications of science is the use of spectacles for the production of high stepping horses. The spectacles, designed and first made by a London firm of opticians, consist of eye enclosing frames of stiff leather and deep concave glasses of large size. They cause the ground in front of the horse to appear raised, and he accordingly steps high. Persistence in the use of the spectacles on young animals is said to give wonderful results. It is suggested that spectacles are also often desirable for correcting the vision of horses, and that certain vice such as shying, which is generally due to short sight might be cured by means of eye-glasses.

Many thousands of tons of sulla (clover) and wheat are annually grown in the Maltese Islands but the latter does not thrive to the same extent as does the former. This is probably due to the greater adaptibility of the clover to its environment, but more especially to that peculiarity which it possesses in common with all leguminous plants of being able to extract free nitrogen from the atmosphere.

It is a process, the *modus operandi* of which is as yet unknown, and this, too, notwithstanding the diligent researches of the most eminent chemists that have lived during the last quarter of a century. Twenty two years ago the French Government offered a prize of £ 10,000 to the chemist who solved the problem.

The reward has not yet been claimed.

A correspondent of *Nature* suggests a very simple plan for the destruction of that familiar pest the mosquito. He tells us that the method was tried in the Riviera a few years ago by an English gentleman who had some property there.

The place in question is a peninsula and for that reason it is exceptionally open to separate treatment. On the Riviera fresh-water is a somewhat rare commodity, and it has therefore to be stored in tanks and other small receptacles. The larvæ of the mosquito live only in fresh water, consequently the tanks are usually the only places that

breed them in any considerable quantity. In the tanks on his property he placed a pair of carp, a fish that is passionately fond of the larvæ, and in a short time he completely extirpated the insects. The plan is not one that could be adopted everywhere, but it is worth bringing under the notice of those whose circumstances are similar to those of the Riviera.

At the last meeting of the French Academy of Sciences a photograph of some fossil leviathans that have recently been obtained from the Mountain Limestone was exhibited.

Among the specimens there delineated was a portion of an *Atlantosaurus*, whose body was about 80 feet in length. Another monster was the *Brontosaurus* which had a body about 50 feet in length, and an exceedingly small head.

While a third, the *Triceratops*, was distinguished by a peculiar hood-like appendage on the head that bristled with spines, and by two horns beneath the eyes and one on the nose.

Its head was about six and a half feet long and terminated in a beak like that of a bird.

Modern discoveries have shown that the prehistoric fauna of the Maltese Islands was of a unique order for it embraced not only a great number of species that were common to both Europe and to Africa. but it also included a number of animals that appear to have been peculiar to this locality. Of the most striking of these mention may be made of *Elephas mélitensis*, an undersized elephant; *Elephas mnaidræ*, a large elephant found in a cave near the ruins of Mnaidra; *Myoxus melitensis*, a gigantic dormouse; *Myoxus cartei*, a dormouse named after Dr. Carter; and to these we may now add a large crane *Grus melitensis;* and a very large vulture *Gyps melitensis.*

In the course of the excavations that have been carried out in Egypt during the past year many valuable and interesting discoveries have been made.

The documents especially, says "Biblia" throw a most interesting light upon many of the social conditions of Egypt at that time and upon the method pursued by the Ptolomies in settling their soldiers in that country and then Hellenizing it. But perhaps the most important and interesting feature of the whole business is the source from which these manuscripts were obtained. Mr. Petrie has discovered what was suspected by others before his time, that many mummy-cases are not made of wood, nor yet of a solid and homogeneous mass of papier-machè or other substance. But they are built up of single sheets of paper, pasted one upon the other, until the necessary thickness is obtained. In many cases the paper thus used is nothing less than old manuscripts torn up and put to this base employment. How many mummy cases are thus composed of manuscripts is a matter of interesting speculation, as is also the question what priceless literary treasures have been thus disposed of. Mr. Petrie has shown that it is possible, after all these centuries, to resolve the mummy-cases into their original sheets, and so to cleanse and restore them as to make them legible. The possibilities of future discoveries that are thus opened up are incalculably great, and the prospect can scarcely fail to stimulate popular interest in Egyptian research.

We have received the first number of "Rassegna delle Scienze Geologiche in Italia" a new review of Geological Science which is being published at Rome under the joint editorship of Messrs M. Cermenati and A. Fellini.

Among the many interesting articles that it contains are a detailed account of the late eruption of Vesuvius written by the wellknown vulcanologist Dr. Johnston-Lavis, and a bibliography of the memoirs bearing on Italian geology that have been written during the past year.

The work is a very useful one, and it should be in the hands of all who desire to be kept posted in Italian geology.

The canary, that is now found so plentifully all round the shores of the Mediterranean, was introduced into Europe in 1478 by Henry of Spain, who brought a number of them from the Canary Islands. For over a century the Spaniards did a thriving trade by supplying the birds, at a very high price, to bird fanciers in the neighbouring countries. A book on "Canaries" that was published at Rome in 1622, tells us that this monopoly was broken up by a curious mischance.

A large number of birds had been sent to Spain in a ship, but a storm arising, the vessel was dri-

ven on the Italian Coast and wrecked. Finding a genial climate the birds established themselves and rapidly spread over Southern Europe. In colour, these Mediterranean birds differ considerable from the typical cage canary. As a rule they are of a brown colour, shading off into grey and a greenish yellow and they have strong, rich, mellow voices.

For all practical purposes the Mediterranean may be accepted as being, what it is popularly supposed to be, a tideless sea, but it is not so in reality. In many places there is a distinct rise and fall, though this is more frequently due to winds and currents than to lunar attraction. At Venice there is a rise of from one to two feet in spring tides, according to the prevalence of winds up or down the Adriatic, but in that sea itself the tides are so weak that they can hardly be recognised, except during the prevalence of the Bora, our old friend *Boreas*, which generally raises a surcharge along the coast of Italy. In many straits and narrow arms of the sea there is a periodical flux and reflux, but the only place where tidal influence, properly so called, is unmistakably observed is in the Lesser Syrtis, or Gulf of Gabes. There the ride runs at the rate of two or three knots an hour, and the rise and fall varies from three to eight feet. It is most marked and regular at Djerba, the Homeric island of the Lotophagi. One must be careful in landing there in a boat, so as not to be left high and dry a mile or two from the shore. Perhaps the companions of Ulysses were caught by the receding tide, and it was not only a banquet of dates, the "honey-sweet fruit of the lotus," or the potent wine which is made from it, which made them forgetful of their homeward way.

Discovery of the remains of a fossil whale near Città Vecchia.

Some-time since a discovery of an unusually interesting description was made in one of the low cliff sections of a field situated midway between Notabile and Casal Dingli.

It consisted of a portion of the body, ribs, and vertebræ of a fossil cetacean.

The remains were found in the transition bed which is subjacent to the deposit that forms the capping of all of the hills of Malta and Gozo; and which is known as the Upper Coralline Limestone. This transition bed is unusually pregnant with the remains of the former inhabitants of the waters in which the Maltese Island were built up.

Sharks' teeth belonging to ten distinct species, crabs, and the remains of numerous tribes of shell fish are plentifully distributed throughout it.

In the present instance, the men employed in the exhumation of this interesting relic of bygone ages, were not careful enough in developing the skeleton and the result was that only a portion of it was obtained; and even that is in a somewhat fragmentary condition.

It has been conveyed to the Museum of the Malta University, where it may now be seen. The most important parts viz: the jaws and the caudal vertebræ have not yet been discovered and it is therefore needful to exercise some caution before committing oneself to an opinion.

These deficiencies have rendered the work of determining the species to which it belonged, somewhat doubtful; though enough has been discovered to afford approximate, if not conclusive, evidence of the genus.

There seems no reason to doubt but that the remains are those of a member of one of the numerous families of cetaceans that frequented the sea which formerly rolled over the area now known to us as the Maltese Islands.

Of these, the remains of the dugong, the menatee (the mermaid, beloved of poets and fable-mongers) the dolphin, and those of several species of whales have been found to be specially abundant.

The present specimen is small one, being not more than 10 or 12 feet in length, and when compared with the remains of some that have been discovered at Chelmus in Gozo and other parts of the Islands, is must be accounted but a midget. Dr. Adams records the discovery of a tooth belonging to a carnivorous whale, Zeuglodon Cetoides, an animal which was not less than 60 or 70 feet in length.

Such a monster as this must indeed have been the terror of the seas in which it lived. It is now, happily extinct.

To the reflective mind discoveries of this kind will serve to furnish ample food for the speculative faculties. They afford conclusive evidence of the great changes and oscillations of level that these islands have undergone in ages, which, geologically speaking, are yet quite recent; and by the irrefutable character of their arguments they enable us to glean some information of the nature of the physical conditions that endured prior to the advent of man.

So wild and impracticable would such a suggestion as this have been considered fifty years ago, that had it then been propounded it would have been unceremoniously dismissed as being no more than the day dream of a mere visionary; yet inductive reasoning, based upon such evidence as discoveries of this kind afford, have enabled man to make such strides in geological science, that the day is now not far distant when the physical conditions of the earth in prehistoric times will be as familiar to him as are those of his own day.

Editor. J. H. Cooke. B.Sc., F.G.S., Malta.

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Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

The Botany and Geology of Egypt.

BY

Rev. Professor Henslow M.A., F.L.S., F.G.S.

The Geology of Egypt is not of a very complicated character, though the age of some beds is difficult to assign. Commencing with the oldest period, the beds consist of—(1), a foundation of crumpled Laurentian rocks, with intrusive masses and veins of granitic or aqueo-igneous rocks, as in the island of Biggeh at Philæ. These strata are principally developed in the hilly country between the Nile and the Red Sea. (2), Argillaceous, chloritic and other schists, probably pre-Cambrian. These are also penetrated by basaltic and felspathic intrusive dykes. These igneous rocks are in the neighbourhood of the Second Cataract, and supplied the Ancient Egyptians with the materials for many of their statues, and the polished blocks of syenite in the interior of the great pyramid. (3) The above palæozoic crystalline rocks subsequently formed insular tracts in a shallow sea, against which sandstones were deposited. This latter now constitutes the desert sandstone, supposed to be of carboniferous or devonian age, as it contains *Lepidodendron mosaicum*. It is conformable with the next—(4)—or Nubian sandstone, which has been variously considered as palæozoic or lower cretaceous. The probability seems to be that this part of Africa was dry land throughout the whole of the Mesozoic epoch, and that the uppermost beds of sandstone became denuded and were then reformed as cretaceous beds. During the middle and later period of the cretaceous epoch the land was submerged, and the deposits now constitute several distinctly recognisable, though conformable, strata visible in the great oasis. They contain species of familiar genera, such as *Inoceramus*, *Spondylus*, *Gryphæa*; Sea-urchins such as our common British *Ananchytes ovatus;* sponges, like the *ventriculites* of our Brighton flint-pebbles.

This cretaceous depression continued on through the Eocene period in which great thicknesses of limestone beds (5) were deposited. These eocene strata are divisible into three series, the lower reaching from the south to about the 26th parallel of latitude. The middle eocene extends thence to Cairo. The upper eocene is scarcely represented there, but occurs more largely a long way off—in the western side of the Libyan desert—where it appears at heights from 70 metres *below*, to 130 meters *above* the level of the sea.

The most characteristic fossils are the numerous species of *Nummulites*, so called from the resemblance of the larger kinds to pieces of money *(nummus)*. A large number of the mollusca are the same as in our own eocene beds, *e.g.*, *Nautilus ziczac*, common to the London clay and the Paris basin.

The Middle Eocene is well represented at the Mokattam hills, which rise to 64ft. behind the citadel of Cairo. The same beds support the Great Pyramid, but they constitute a "down-throw," being only 160ft. above the Nile, which flows along the line of fault. *Nummulites*, *Gizehensis*, *curvispira*, *discorbina*, &c., are characteristic of the basement beds of this Middle Eocene series, associated with *Cerithium giganteum*, and other species familiar to English geologists.

Above the preceding bed follows others, with shells shewing a correspondence with the lower Parisian beds, containing *Pecten parisiensis*, &c. Much gypsum occurs in these beds here.

This Mokattam limestone contains flints resembling those of the Upper Chalk. By the weathering of the limestone, they form complete surface layers. On the west of the Nile most denudation has taken place, so that there pebbles occur strewn over the desert. They split through the action of heat and cold, for the temperature often varies to the extent of 35 degrees in seven hours. They are often coloured in bands by oxide of iron.

A brown uppermost layer contains many oysters, *Conus*, *Voluta*, *Turritella*, and the characteristic bivalves, *Placuna* and *Carolia*.

The Upper Eocene strata are developed, as stated, mainly at the extreme western part of the Libyan desert. They consist of limestone beds of 10 metres in thickness, and are the equivalent of the Barton Clay.

The first important elevation took place at the close of the Eocene times, so that the beds of that age formed soils for trees of the genus *Nicolia*, as well of palms and pines, now constituting the well-known fossil forests near Cairo. They belong to eight genera, including one palm, a conifer, seven exogens, some of which were from 70ft. to 80ft. in height. They are allied to the existing Sudan flora.

A hill called Gebel-ahmar, or the red mountain, is supposed to be also of Miocene age. It is composed of sandstones and conglomerates, and contains what have been supposed to be old Geyser-pipes. The induration of the rocks, and silicification of the trunks of the trees, are thought to be due to these old hot silicious springs. The hard sandstone is used for millstone and statues, a very ancient one being at Ismailia.

No recognised deposits occur of the Pliocene age, as during this time the land was continental, the the Nile emptying itself into a great enclosed saline basin on the east.

As the elevation of Lower Egypt took place, the Nile valley became still more contracted, patches of sea-beaches being now discoverable at intervals as at Mokattam, near the Great Pyramid and up to Silsilis, proving that an arm of the sea extended far up the Nile. These beaches also occur at Alexandria, the Red Sea, Syria, Jaffa, and at Beyroot to the height of 200ft., indicating an extensive pleistocene submergence.

As an illustration, in the cliffs behind the tombs of the Khalifs at Cairo, and at an elevation of about 30ft., the rocks are perforated by the Lithodomus of the Mediterranean Sea, and abound with *Ostrea cucullata* of the Red Sea, as well as with *Balani*, all being of existing species.

Near the Pyramids there is another example at the summit of a knoll known as Het-el-orab, or" Crow's Wall;" where a depression occurs between it and the Pyramids, which is partly natural and partly artificial, as the Sphinx is cut out of the solid rock. The beach consists of rounded fragments of limestone, with a few basaltic-like pebbles, the interstices being packed with oyster shells. It is about 40ft. above the bottom of the valley.

As the land rose and the sea retreated, Egypt became higher than at present, as sand is found at a depth of 30ft. to 40ft. below the Nile mud, show-

ing that the Delta was at that time part of the desert, when the Nile ran in a deep channel and perhaps more to the east than now, the fresh water deposits occurring at the Isthmus of Suez being probably of this period.

A subsequent slight depression near the beginning of the historical period placed it in a position to receive and retain the mud. It has been calculated that the Nile mud is deposited at the rate of nearly five inches in a hundred years. This will give a date of about 10,000 years for the growth of the Delta.

The first period of human occupation is indicated by flint implements. That there was a stone age in Egypt appears to be now well established and recognised since 1869. Many implements have been found about Thebes, in the Oasis, and elsewhere. They consist of flakes, cores (usually one-sided only), hammers, arrow-heads, lances, scrapers, saws, heads of hatchets,&c.

The Egyptians, as Herodotus tells us, continued to use flints for the purposes of mummification, &c., though iron was of course in use.

The numerous depressions and elevations of Egypt, as well as dislocated strata on the east and west side of the Nile, indicate the action of great forces, so that the fact of earthquakes having taken place is not surprising. The frightful havoc done to the temples in Upper Egypt can apparently only have been caused by earthquakes.

The valley of the Nile was primarily determined by ridges of the old crystalline rocks on the east- which caused the flow of drainage to proceed northwards, and prevented a direct communication with the Red Sea. It was also influenced by the fractures and faults occurring in the elevation of the Eocene beds the west side of the Nile being a downthrow which produced lines of weakness along the course of the present valley. Much of the actual cutting of the valley must have been effected by the sea in times of pleistocene submergence. Many inland cliffs and "Wadys" were then formed together with the scattering of boulders from the eastern crystalline mountains over the Libyan desert as at Denderah.

That the Nile, or perhaps a branch of it, once flowed eastwards appears to be probable from the existence of fresh water strata around Ismailia, occupying the highest part immediately north of the town on the Isthmus of Suez, and extending a considerable distance east and west. They consist of a thin-bedded grey limestone in horizontal beds, resting on marls, sands, and clays, with gypsum and nodules of chalcedony. This formation would seem to imply the discharge of the Nile, or of a considerable branch of it, eastwards—not into a marine estuary, but into a saline lake. This may perhaps account for the identity of the Nile and Jordan fishes, the latter river having had some communication with this eastern branch of the Nile.

The "Fungus Melitensis."

This plant was believed to be peculiar to the Maltese Islands only, a belief in which I also shared, and which I expressed to Dr. J. Murray during his late visit. Now, however, it has been shown that the above name is but a local synonym for "*Cynomorium coccineum L.* and that the plant has a much wider range than has hitherto been supposed a fact which led Prof. Carmel refer to it in the International Congress held at Florence in 1874 as—"une des grandes raretes de la flore europeenne. Une plante que pas un botaniste peutetre sur cent n'à l'occasion de voir vivante."

But these facts do not detract from its interest, and a few details bearing upon it may not therefore be considered out of place in a journal that is devoted to the Natural History of the Mediterranean and its islands.

The misleading character of its popular name is now well known. It has no more right to he called "Melitensis, than it has to be called a fungus, although this is its pharmaceutical name in Linn. Materia Medica where in 1749 the plant, under the binomial nomenclature, received the name which it now bears.

In the Maltese vernacular it is called "Gherk el general," or "Gherk signur," which means. "The general's root", because the first known habitat was on the *Hagra tal general*, a detached rock situated at the north western extremity of Gozo, and which received the name of the "Fungus rock" in consequence of its presence.

The medicinal virtues of the plant were fabulously exaggerated in former times, and have thus led to its being mentioned in nearly every work that

has been published about the Maltese Islands since the time of the G. Master Lascaris. The Commendatore Abela refers to it in his "Descritione di Malta" in 1647, where he speaks of it as a herb of a reddish colour, which when dried and reduced to a fine powder has most salutary effects if used as a drink in cases of dysentery. (L. 1. Not. X.).

The first to note the plant scientifically was J. J. Bonamico who, prior to 1670, wrote a pamphlet on it entitled "*De fuco spicato coccineo melitense;*" and P. Boccone in 1697, described it in his "Museo di Fisica," and in a note he dedicated it to Sir J. Hoskin Bart, President of the Royal Society of London.

In this work he records many observations about the "*Fungus thypaides coccineus, tuberous melitensis*" as he calls it; and he mentions several other places besides Malta, in which it occurs. He speaks at considerable length, according to the popular ideas of his times, of its medicinal properties; and in support of his statements he mentions several remarkable cures that were due to its efficacious properties.

He call it "*Thypoides,*" owing to its resemblance to the stems of the *typha;* and he suggests that it might be usefully employed instead of other medicines.

Bonamico's ideas on the plant, were reproduced in Count Ciantar's *Malta Illustrata*, 1772; and his quaint ideas on the subject are a sample of the first stage of science of the pioneers of Maltese Natural History. He observes that Abela was not exact in calling the fungus a herb, whilst it ought to be called a fruit, and that he was likewise mistaken in restricting its habitat to the "Hagra tal general" because it grows also on the opposite coast of Gozo at Dueira.

In speaking of its uses he describes the manner in which it ought to be prepared and given, and he extends its effects to cases of Apoplexy and Gomorrea. Nothing is known he says, how it came to be discovered, but that some Maltese women banished to Gozo were the first to learn its valuable properties, and among whom later on prevailed the custom to hang the plant on their breasts as an amulet of future happiness, but, he severely adds, a Capuchin Missionary put a stop to this custom. Ciantar concludes saying that in his time the Fungus was reserved for the Grand Master's use, which Prof. Gulia confirms in his "*Repertorio Botanico Maltese,*" 1855, asserting that two men for 50 Scudi each year were charged with the custody of the Fungus, and a Proclamation issued in 1800 under Sir Alexander Ball ordered that the rules regarding the protection of the Fungus were to stand good as under the previous Goverment, prohibiting to persons of all conditions to collect it without a permit from His Excellency or from his Secretary.

These measures show clearly how much prized the Fungus was and what an active search for if went on, and I do not know of any other indigenous plant so much cared for and protected except the "*Ononis ramosissima*" commonly called "*Broxga,*" which was and is still used for baking purposes, about which there is a paragraph in Book VII. C. XII., of the Codice Municipale promulgated under G. M. De Rohan, prohibiting its being cut before May under a penalty of "30 tari".

Now a days the Fungus is only looked for as a botanic curiosity, its medicinal properties not being made much of.

I have been often asked the best way to obtain specimens of it from the abrupt places where it grows. Since the interruption of the rope comunication with the General's Rock this is generally not a very easy thing, but I have always managed to have it by going in its time of flowering to the cliffs off Casal Dingli where it is also to be found on the rocks overlooking the sea, and there ask for it of some countryman of the locality, as many know of its value and would be glad to fetch if on consideration of a trifling gratuity.

Its flowering time is April and May.

The Cynomorium is the only representative of the Order of Balanophoraceae in Europe and is distinguished as Parlatore observes from its congenera because these prefer inland woody districts while the Cynomorium is to be found only in sandy places and along the coasts. It lives parasitic on maritime plants such as Atriplex portulacoides L., Inula chrytmoides L., Salsola fruticosa L., etc. Its distribution as given by the same Parlatore is wide enough, embracing Cadiz, Carthage, Aranjuez, Sardinia, Italy, Favignona, Lampedusa, Malta, Tunis, Algiers, the Island of Lance-

rotta and Mount Sinai's region, but it is never a common plant.

Linnaeus on Brown's authority adds Jamaica to its habitat (Mas. Med. 524, Sp. pl. 1375, Amaen. Acad. I. 2, 351), but Weddal remarks that it is probable that he mistook an *Helosis* for it.

It must be added lastly that the Cynomorium has been thoroughly studied in Weddell's "Memoir per le Cynon cocc. 1841" which contains all considerable information on the subject.

ALF. CARUANA GATTO.

Observations on the Geology of the Maltese Islands

BY

JOHN H. COOKE.

I have, so far, been considering the general geological and physical features of the Islands. I will now proceed to investigate more closely the numerous phenomena that exemplify the laws to which the strata owe their structural characteristics, and to note the principal facts relating to their stratigraphy, lithology, and paleontology.

The Lower Coralline Limestone:—This formation is the lowest of the series of strata of which the Maltese Islands are composed. It extends throughout the length and breadth of all of the islands, but it is not exposed to any great extent in either Malta or Gozo, nor does it appear in the islets of Filfola, Comino, and Cominotto. In Malta it forms mural cliffs that extend all along the southern coast, and which in many parts rise to a height of upwards of 400 feet above the level of the sea. The surface exposures are limited in area and are found to occur only in the eastern half of the island. The denudation to which the overlying Globigerina Limestone has been subjected has laid bare tracts of it of varying extent around Marsa Scala, the greater part of the area between Casals Asciak, Chircop, and the shores of Marsa Sirocco, the shores of Ricasoli, St. Julians, the Dragonara, Pembroke, and the Salines: and in the interior, the areas in the vicinity of the Lunatic Asylum, Zebbug, and Musta.

In the islands of Gozo where the work of denudation has not been so effective, a much smaller area lies exposed. The sides of the north-west, and south-west coasts are the only localities. The rock varies in its lithological structure in various part of the beds, sometimes being very granular, and having a coarse oatmeal texture, and sometimes being of a decided crystalline character.

Dr. Murray subjected several specimens to a chemical analysis the results of which showed the rock to contain about 97. 5 per cent of carbonate of lime, the remaining 2. 5 per cent being made up of oxide of iron, alumina, and minute grains of quartz, augite, felspars, tourmaline, and glauconite.

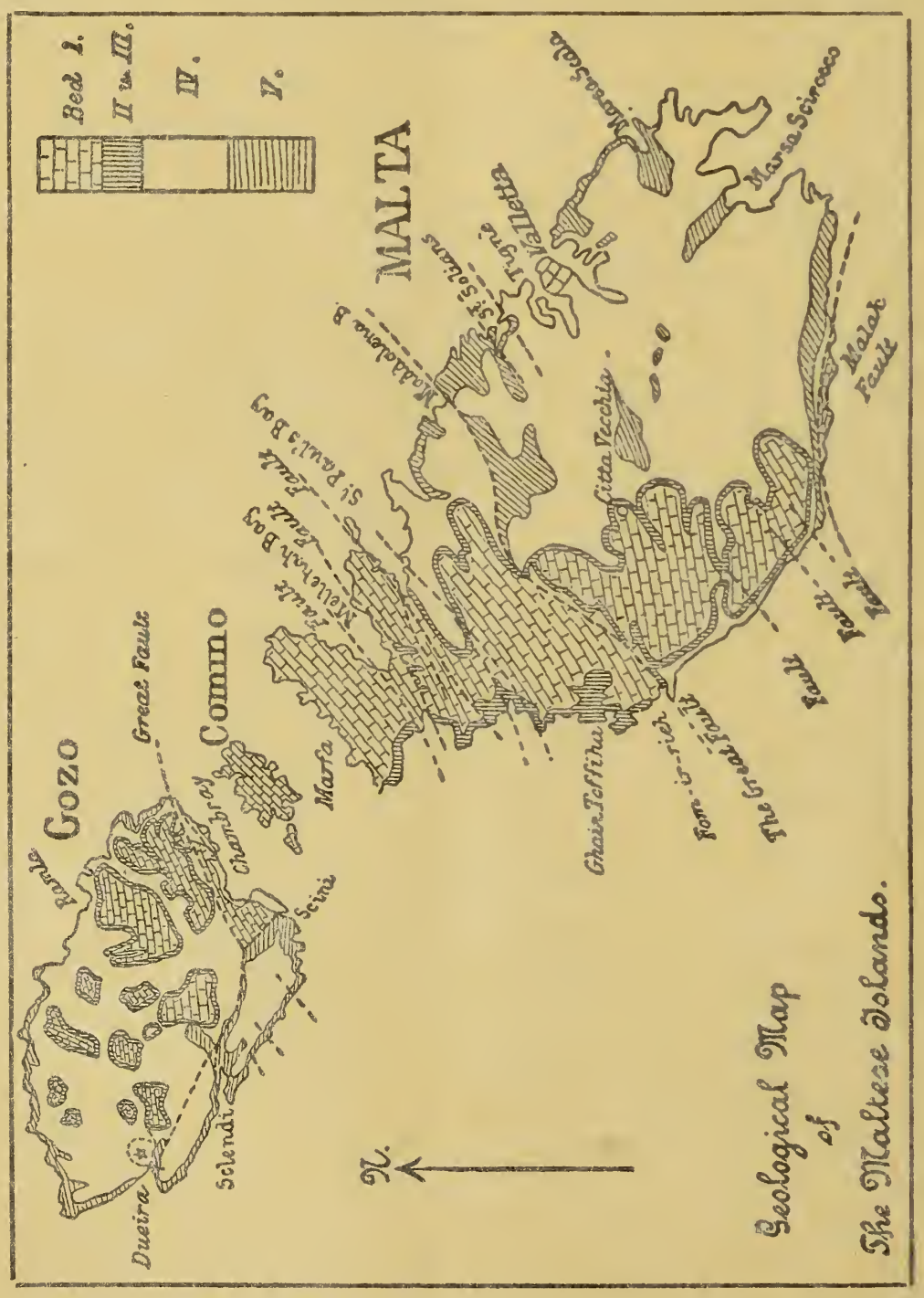
It contains no phosphoric acid or the merest traces of it, and this combined with the extreme hardness of the rock tends to render the soil formed from it very poor in quality, and very scant in quantity.

It furnishes large quantities of excellent building material, the softer kinds being largely used for external decorative purposes, while the harder varieties, which take a good polish and are therefore known locally as "Gozo Marble" or "Gozo Granite," are used in sub-marine constructions, and in those portions of buildings that are subjected to hard wear and tear and in which durability is therefore a *sine qua non.*

Of the thickness of the formation it is impossible to give any definite information as there are no means of determining how far the bed extends below the sea level, but at Emtahleb and Duera the Lower Limestone cliffs tower to a height of about 400 feet, while the 50 fathom line runs close in shore in both of these localities so that we may conclude that thickness is much greater than that which is shown by the cliff faces.

Every portion of the bed abounds with organic remains, but as a rule the extreme hardness of the matrix in which they are embedded renders the work of extracting them, a task of great difficulty. Dr. John Murray's researches showed the rock to be made up almost entirely of Nullipores *(Lithothanmion)*, and other calcareous Algae, intermixed with which were Foraminifera fragments of Molluscs, Polyzoa, Corals, and Echinoderms. Diatomacæ *(naviculæ)* and corallines are specially numerous in the lower divisions of the bed; while the corals *Stylocœnia lobato rotundata* and *Denarophillia irregularis* occur in separate masses in abundance in the upper portions. The shores of Duera Bay in Gozo, of the

Dragonara in Malta and of other localities where this bed lies exposed, abound with a beautiful sea-urchin *Scutella subrotunda*, which forms deposits of from two to three feet in thickness. This scutella bed generally marks the line of demarcation between the Lower Coralline Limestone and Globigerina Limestone, but it is sometimes replaced, as at Ricasoli, by a soft, white variety of rock abounding with the spines and tests of several species of Cidaris with quantities of *Heterostegina* and with great numbers, of a small brachiopod *Thecidium adamsi*.



At Il Mara, Fommer-Rih, and Migiar Scini, too, the rocks along the shores contain considerable quantities of the flat foraminiferous molluscs *Heterostegina*, but as a rule they are much larger, and more strongly developed than are the *Heterostegina depressa* of the "Greensand" bed. Along the shores of St. Julians Bay in Malta, and in the Munsciar Gorge in Gozo a very large species of *Heterostegina* occurs in considerable quantities. It often attains the size of a half a crown piece, and therefore to distinguish it from the smaller varieties Dr. Adams named it *Heterostegina Stricklandi*.

Another organism that is equally abundant near St. Leonardo and St. Georgio is a thin, flat, discoidal foraminifera *Orbitoides Mantelli*, most of which attain a diameter of from 3 to 4 inches, and associated with them is another species of a biconvex form *Orbitoides despansus* (Sowerby.) The mollusca and the echinodermata are also largely represented as will be seen upon referring to the list of the fossils of this formation. In the semicrystalline portions of the upper parts of the bed the smooth, golden colored, button-shaped teeth of the large skate *Myliobates*, are found associated with the palatine teeth of a large globe-fish *Diodon;* and at Fomm-er-Rih at the same horizon there is an extensive bed composed of *Ostrea navicularis*, and *O. boblayei*.

Owing to the crystalline character of the rock, the difficulty of obtaining access to the best sections of it, and its extremely hard nature this formation has not been so thoroughly worked out as the other beds have. Further researches will, therefore, I have no doubt, be the means of making many more additions to its fossil fauna.

The Globigerina Limestone:—Until recently, this portion of the Maltese deposits was known as the "Sandstone" or "Freestone" group. Captain

Spratt, Dr. Adams, Von Th Fuchs, and other geologists considered it as such, and it was not until the results of the investigations of Dr. John Murray were made known, that the real significance of the misnomer was apparent.

From the analyses made by Dr. Murray it was shown that there was but 12.88 per cent of insoluble matter in the samples that he analysed, and that, that residue was made up of silica, ferric oxide, alumina and a small quantity of lime. On the other hand, there was found to be as much as 80.24 per cent of carbonate of lime. (1)

Sections of the rock were made, and were examined under the microscope, and it was shown, that the carbonate of lime consisted of the shells of foraminifera, the greater number of which were *Globigerina.*

The name of the deposit was therefore changed to one that more accurately described the characteristics of the formation, and instead of "Sandstone", it is now known as the "*Globigerina Limestone.*"

The formation extends throughout both islands; but in the north western and western parts the deposits, that overlie it, entirely mask it from view. In these localities, the only means of access to it, are those afforded by the outcrops along the hill sides, the faces of the faults, and the sides of the valleys.

But in the East, and South East of Malta, and in the South West of Gozo, a very different state of things prevails.

In so thorough a manner have the upper deposits, there, been denuded down, that not a vestige of them remains in an area, that may be taken as representing at least two thirds of the extent of the two islands. Over this area, the Globigerina Limestone forms, with few exceptions, the surface deposit.

In several localities, there are isolated patches, where the eroding agents have laid bare the underlying Coralline Limestone; but so insignificant are they in size, that their aggregated areas would not amount to one twentieth of the total area of the islands. It is principally in the western half of Malta, that they are to be found; thus at the north-eastern extremity of the Great Fault, and proceeding in the direction of the line of the Fault to within a short distance of Ta Binjemma, some excellent sections are exposed to view.

A limited area around Musta, Zebbug, the Lunatic Asylum, the shores of St. George's and St. Julian's Bay, from the shooting range at Ricasoli to Zoncar Tower, the shores of Marsa Scala, and the whole of the cliffs extending from Marsa Sirocco in a north-westerly direction to Fommer Rih, will afford good oppportunities for studying the nature of the work, that was effected when the Globigerina deposits were swept from these areas.

In Gozo, the work of denudation has not been so extensive; and the Globigerina bed, even where exposed at the surface, preserves a uniform thickness throughout. The only remarkable exceptions to this, are found in the gorges of Migiar Scini, Cala Sclendi and Cala Duera, in each of which the Lower Limestone has been laid bare. The distribution of the formation as a surface deposit, is more complicated in Gozo than in Malta.

The Globigerina beds of Gozo, lie exposed over an area equal in extent to about one fifth of that in which it is found to occur in Malta.

The stone of the formation varies too considerably in colour and quality.

The late Admiral Spratt, considered that the formation was made up of at least, five varieties of rock. But this is, a question, upon which there is some difference of opinion, as the kinds of rock, of which the bed is composed, are very various in their character, and appearance and in the positions of the horizons that they occupy in different parts of the formation. All of the different varieties are fine-grained, and are of a porous texture.

They are, therefore, easily tooled; and are much used for building purposes. The prevailing colour of the rock is a whitish grey, sometimes inclining to a yellow, and then passing into a reddish or orange brown. Situated at about the middle of the formation, there is a dark-blue rock, which persistently occupies the same relative position throughout the bed. It is of an exceedingly perishable nature, and is, therefore, but little used for economic purposes. At Sliema, Tignè and at Marsa Sirocco sections of it, exhibiting a considerable thickness, are to be seen all along the

(1) "*The Maltese Islands with special reference to their Geological structure*" *Dr. J. Murray 1889.*

shore cliffs. This variation in the colour of the strata, is due in a great measure, to the varying states of combination of the iron that pervades them.

The gradations from a cold-grey to a yellowish hue through which the various divisions of the bed pass, are due to the extent to which this admixture takes place. Dr. Dawson, in a paper read before the Geological Society (1) advocates the view that the colouration of rocks is due to the decomposition of iron pyrites and that the sulphuretted hydrogen produced by the decay of organic matter acting on the sesquioxide converts it into bisulphide, and thus a colouring matter is formed; and further researches conducted by other well known scientists seem to support this hypothesis. (2)

There are, however, some cases among the Maltese rocks which Dr. John Murray considers admit of a simpler explanation. It is his opinion that the original colour of the whole of the formation, was a dark-blue; and that the colours that the rock has now assumed are the result of the oxidation of the iron pyrites, that it originally contained. He says "While these rocks are, for the most part, of a reddish or yellow colour, along the cliffs on the coast, and in the cutting for the New Dock, there are large, more or less, circular bluish patches, and it is noticed, that these blue patches are removed to the greatest distance from faults and fissures. In the bluish, or grey-coloured upper-beds, and even in the over-lying blue clay itself, the rocks on each side of a fissure have a red colour, the thickness of this reddish band on either side of the fault or fissure being less, as a rule, the more the bed contains.

The microscopic section of the red rocks and the blue patches show no difference, so far as concerns the organisms, but the blue patches contain iron pyrites, which is absent in the red rock through oxidation, the iron pyrites often filling the foraminifera and forming casts of the shells.

(1) Quart. Journ. Geo. Soc. Vol. XXXIII. p. 114.

(2) Dr. Sterry Hunt. Quart. Journ. Geo. Soc. June 1859. J. W. Young "Chemistry of Carboniferous, and Old Red Sandstones."

It thus appears more than probable, that these blue patches will ultimately disappear with further oxidation; indeed it is evident to me, that at the time these Globigerina rocks were first raised above the sea, they were all of a blue colour, and that the red colour is entirely due to subsequent oxidation, the more porous calcareous bed having been oxidised at a more rapid rate, than those containing a large quantity of clayey matter."

Interstratified with the beds of this formation are several seams, or layers of phosphatic nodules, that consist, for the most part of aggregations of brownish masses, together with a great abundance of the phosphatised remains of mollusca, echinoderms, corals, whales, dolphins, sharks, rays, seals, turtles and other creatures; the whole being firmly bound together by the fine calcareous matter, that was rained down upon them from the waters of the ocean above.

All of them, when broken, will be found to contain an organism, around which the phosphatic matter has segregated.

The fossilised remains of the contained organism, too are generally of a brownish black hue, a condition, that is probably owing to the combination, either of the phosphoric acid contained in the organism, or that derived from the animal remains around, with the iron contained in the rock.

It is to the phosphate of iron thus formed, that the change in their original appearance is due. These nodules seams often attain a thickness of from 2 to 3 feet; and, at least one of them extends throughout the length and breadth of both islands.

A remnant of one may be seen at Tignè point marking the transition between the Globigerina Limestone, and the Lower Coralline Limestone; while another, of considerable thickness may be seen on the shores of St. Paul's Bay.

In some localities, these seams are entirely absent, and in others they thin out from a thickness of two and three feet to as many inches.

The cliffs at Marsa Scala, at the Gozo lighthouse, at Dueira, and at Fomm-er-Rih, offer every facility for a close examination.

At Fomm-er-Rih, four seams are very distinctly marked; but that which usual indicates the line of transition between the Globigerina limestone

and the Lower Coralline limestone attains the greatest thickness, and is the richest in organic remains.

All of the fossils contained in the seams are indigenous to the formation. The nodules are of all shapes and sizes, and their exterior surfaces, usually, present an exceedingly wrinkled and coriaceous appearance.

With the exception of the one at the junction of the Lower Limestone and the Globigerina bed, these nodule seams are, by no means, uniformly distributed throughout the island. The lowest seam is important both an account of its persistence, and of the invariable character of the organic remains that it contains.

(to be continued.)

Mediterranean Lepidoptera.

While serving a three years' commission on board one of H. M. Ships in the Mediterranean opportunities presented themselves to me of insect hunting at various parts on that Station.

Of one place, MARMARIE, that we visited probably very little is known and I much regretted that circumstances prevented me taking more than two walks there for Entomological purposes. This bay seems to be an ideal spot for the purpose, lowlying and well-watered woods, and plains, as well as lofty hills more or less tree covered being within easy reach from the landing place. Among the low-lying woods which are principally composed of gum trees I noticed a single specimen of *Vannessa antiopa*, as well as an especially large number of *Papilio podalirius*, *Hipparchia allionia, and Hyperompa hera.* At the back of the village in a fig orchard near a watercourse, I captured an absolutely perfect specimen of *Papilio machaon*, the only one of the species seen. *Limenitis Camilla* is also found here as a very local insect but plentiful where occurring at all. Amongst the Blues I caught *bœticus*, *argiolus telicanus*, *astrarche*, and *icarus* var: *icarinus.*

NAVARINO is another place that from a Lepidopterists point of view would well repay a visit. The country here is not so varied as at Marmarice and it is as well to confine attention to the plains and gullies only. On them in large numbers are found *Melitœ didyma* var:, *Colias edusa*, *Papilio Machaon* and *podalirius*, and more rarely *Gonepteryx rhamni* and *cleopatra.*

AT SPEZIA the characters of the insects is considerably different, *Nymphalidæ* and *Hesperidæ* being the most generally found. The *Satirinæ* are especially well represented by *Hipparchia briseis* and *allionia*, *Cœnonympha arcania* and *pamphilus* var:, etc. *Leucophasia sinapis* and *erysime* are also frequent.

Of the seventeen butterflies known to inhabit MALTA I have caught between March and May, *Oieris brassicæ*, *rapæ*, and *daplidice*. *Colias edusa*, *Papilio Machaon* var: *Sphyrus*, *Lasiommata megara*, *Epinephile hispulla*, *Cœnonympha Pamphilus* (and a var:), *Vanessa Cardui Chrysophanus Phlœas*, and *Polyommatus icarus* and *bœticus;* and have seen *Gonepteryx rhamnis*, *Vanessa atalanta*, and *Colias edusa* var: *helice;* leaving unaccounted for *Gonepteryx cleopatra*, *Lasiommata egeria*, and *Polyommatus astrarche.*

Colias hyale has been reported as occuring at Malta but probably by mistake for *C. helice.*

Many varieties of butterflies are found on the syringas and flowering shrubs and bushes generally in the King's Gardens and around the lagoon at CORFU. More Especially *Limenitis Camilla*, *Vanessa atalanta*, *Satyrus roxelana*, *Melitœ didyma*, *Pamphila sylvanus*, and *Thymelicus actæon*, in the King's Gardens and *Colias Edusa*, *Papilio machaon*, *Pieris daplidice*, and *Hipparchia semele* by the lagoon. Two specimens (male and female) of *Papilio alexanor* were caught by a friend of mine while driving along a high road.

MALAMOCCO which is not much better than a sandbank has as might be expected little more than *Polyommati* and *Cœnonympha* but there are scattered specimens of *Lasiommata megara*, *Pieris rapæ* and *Laplidice*, and locally a few *Hesperidæ*.

There is a happy hunting ground up the valleys to the west of TRIESTE. *Aporia crathœgi*, *Polyommatus adonis* and *œgon*, and various species of *Melitœa* and *Thecla* being the most frequent besides a few *Colias hyale*, *Satyrus adrasta*, *Argyn-Laphne*, and *Polyommatus alcon.*

At CATTARO the weather was too hot (96° in the shade at 4.0 p.m.) to be energetic otherwise probably the result of a day's work would have been very satisfactory as vegetation is luxuriant.

Hipparchia proserpina occurs at Rosas Bay (E. Coast of Spain), and Fiume. At the latter place I also saw *Apatura iris* (or a var: of it) and on the top of a hill a single specimen of *Papilio alexanor*. *Epinephile ida* is common on the Dalmatian Coast.

I shall be very glad to answer by letter any queries concerning the localities mentioned.

Philip de la Garde.

List of Lepidoptera
Captured in the Mediterranean.

DATE	PLACE	NAME
27.6.89	Civ. Vecchia	Melanargia procida
		Zygaena erythrus
		„ groslini
		Lasiocampa sp.
		Clisiocampa castrensis
10.7.89	Port Mahon	Liparis dispar
– 9.29	Stamphalia	Acherontia atropos
– 10.89 and 19.7.91	Nauplia	Hipparchia fatua
		Epinephile lupinus
		Cœnonympha pamphilus
		Leucophasia æstiva
		„ erysime
		Polyommatus argiolus
		„ icarus
		„ telicanus
		Chærocampa celerio
		Acidalia ornata
		Crambus sp.
– 3.90	Malta	Aspilates citraria
		Cornifrons ulceratalis var.
4.11.90		Macroglossa stellatarum
– 3.91 to – 5.91		Lasiommata megæra
		Epinephile hispulla
		Cœnonympha pamphilus
		Pieris brassicæ
		„ rapæ
		„ daplidice
		Colias edusa
		Papilio machaon var. sp. hyrus
		Chrysophanus phlæas
		Polyommatus bœticus
		„ icarus
		Callarctia pudica
		Deiopeia pulchella
		Lasiocampa sicula
		Plusia gamma
		Triphæna pronuba
		Synthymia monogramma
		Acidalia asellaria?
		Venusia sp.
		Eubolia sp.
		Pyralis sp.
		„ farinalis
		Aglossa pinguinalis
		Botys ferrugalis
		Tortrices four. sp.
		Ephaleroptera ictericana
		Tineœ, four. sp.
		Pterophorus sp.
		Deilephila euphorbiæ (from pupa)
		Lasiocampa quercus (from larva)
		Calocampa exoleta (from larva)
9.6.90	Jaffa	Pieris rapae
		„ daplidice
		Lycæna thersamon
20.6.91	Limasol	Epinephile hispulla
		Spilothyrus marrubii
29.6.90 and 3.7.90	Marmarice	Hipparchia allionia
		„ fatua
		Cœnonympha pamphilus
		Limenitis camilla
		Colias edusa
		Papilio podalirius
		„ machaon
		Chrysophanus eleus
		Polyommatus argiolus
		„ bœticus
		„ icarus var. icarinus
		Hypercompa hera
		Camptogramma bilineata var. testaceolata
10.7.90 and 9.7.91 to 13.7.91	Navarino	Hipparchia fatua
		Epinephile hispulla
		„ lupinus
		Lasiommata megæra
		„ egeria var.
		Cœnonympha pamphilus
		Melitæa didyma var.
		Vanessa cardui
		Pieris brassicæ
		„ rapæ
		Gonepteryx rhamni
		„ cleopatra
		Colias edusa
		Leucophasia æstiva
		Chrysophanus eleus
		Polyommatus argiolus
		„ telicanus
		Pamphila nostrodamus
		Epilothyrus marrubii
		Macroglossa stellatarum
		Margaronia unionalis
		Mecyna Poligonalis var.
7.9.90 and 8.9.90	Spezia	Hipparchia allionia
		„ briseis
		Epinephile sp.
		„ hispulla
		Cœnonympha arcania
		„ pamphilus
		„ „ var.

		Argynnis dia
		Pieris brassicæ
		„ rapæ
		Colias edusa
		Leucophasia erysime
		„ sinapis
		Polyommatus icarus
		„ telicanus
		Pamphila comma
		Thanaos tages
		Fidonia atomaria
24.5.91 to 27.5.91 and 6.7.91	Corfu	Satyrus roxelana
		Hipparchia semele
		Epinephile hispulla
		Cœnonympha pamphilus var. lyllus
		Melitæ didyma
		Vanessa atalanta
		„ C. Album
		„ Egea
		Limenitis camilla
		Melanergia larissa var.
		Pieris brassicæ
		„ daplidice
		Etrymon W. Album
		Polyommatus icarus
		„ telicanus
		Pamphila sylvanus
		Thymelicus actæon
		Zygæna filipendulæ
		„ punctum
		Arctia villica
		Callimorpha jacobææ

(to be continued).

Theories of Mountain Formation.

BY T. MELLARD READE, C.E., F.G.S., F.R.I.B.A.

Part IV.

It will be understood from the principles enunciated in Part III. that the surface layers of the earth are unaffected by expansion; it is only as they become buried in sediment that increasing heat can affect them. On the other hand, what geological indications have we in them of the effects of the secular contraction of the globe? The contractionists point to the folds of the great mountain ranges, but these, as already shown, only occur in areas of sedimentation. It would certainly seem that the secular contraction of the earth, if capable of producing these effects, should not be confined to areas of great sedimentation. We should expect to find old rocks in areas of denudation also thrown into folds and mountain ranges. As a matter of fact, no instance can be pointed to of a mountain range which has been entirely formed of old rocks. Old rocks are *disclosed* by the denudation of a range itself, but these have been the "foundation stones" of the range itself.

If but one mountain range could be shown by the contractionists, to have been produced without the aid of sedimentation, their theory would be founded on a sounder basis of induction than it is at present. But it will be said, "even admitting the view that you take of the effect of secular contraction, and the existence of a level-of-no-strain in a cooling globe, the compression of the under layers of the earth must have produced some geological effects." Secular contraction may have left its mark on the earth in some way not at present understood, and it will take a great deal of investigation of a less crude character than seems to satisfy some geologists, to settle this point. If, however, we consider that the layers of the earth in compression now—on the favourable supposition that the surface remains constant and unalterd except by such compression, which is the condition assumed in all the calculations of the depth of the level-of-no-strain—is at the maximum estimate under five miles, and the minimum under two miles deep, we get a clue to the absence of geological evideuces of secular contraction. There are very few calculations of geological time—at all events by those who have studied geology—that put the earth's history at less than 100,000,000 years, my own calculations being much in excess of that figure; (1) but for the purposes of mathematics one important condition in the calculation of the level-of-no-strain has been omitted, and that is *denudation*. I have pointed out in the "Origin of Mountain Ranges" that this agency would go far towards obliterating the geological effects of secular contraction.

As a rule, those geologists who believe that the earth's corrugations result from the contraction of the earth's nucleus also contend that geological agencies, such as those producing denudation, were much more active in the early ages of our planet, in which case a greater thickness of the earth's crust must have been removed in a given time than what I am disposed to allow. Let us,

(1) Chemical Denudation in relation to geological time.

however, take the low rate of denudation of 1 foot in 4,000 years. (1) Then, in 100,000,000 year, the denudation would amount to 25,000 feet, distributed evenly over the land areas of the globe. In mountain regions this figure would be exceeded many fold, as calculations are given by American geologists of denudations equal to, or exceeding, this that have taken place in late geological periods in particular areas of the United States.

My own opinion is that the denudation of the land areas of our globe since the dawn of geological history has vastly exceeded this figure, but as Mercutio in "Romeo and Juliet" says of his wound, "'Tis not so deep as a well, nor so wide as a church door; but 'tis enough, 'twill serve."

In round figures, five miles of denudation would equal the *maximum* calculation of the depth of the level-of-no-strain. What would be the effect of this conditioning agency on the position of the level-of-no-strain? In the absence of other antagonistic forces it would remove most of the evidences of compression produced by secular contraction in the outer rind of the earth.

The problem is an exceedingly complex one, and to some extent involves the question of the permanence of continents and oceans; but even granting for the sake of argument what I do not believe is the fact, that continents have always been where they are now, the removal of this amount of rock would of itself lower the isogeotherms to the same extent. That is, if a layer of the earth situated five miles deep were denuded of its covering till it reached the surface, it would have its temperature lowered, contraction would take place, and the conditions upon which the calculations of the depth of the level-of-no-strain are made would be materially modified. On the other hand if, as I believe with Hutton, Lyell, and the older school of geologists, every portion of the surface of the globe has been at one time or another subject to denudation, and the total amount of material removed from one site to another is much in excess of the calculation given, the non-existence of corrugations traceable to secular contraction is not remarkable.

(1) *See "Denudation of the two Americas."*—Presidential Address, Liverpool Geological Society, 1884-5.

But as I have pointed out elsewhere (1) if the shrinkage of the Earths nucleus were an active force now, the outer crust would be in a constant state of stress so that any artificial excavation made in rock in any part of the globe would release a portion of this stress to the extent of the area and depth of such excavation. No such general state of stress in the Earths Crust is discoverable but local stresses do exist which are released by quarrying operations so that trenches cut across the floor of a quarry sometimes suddenly close up, instances being detailed in the paper referred to. The rarity of this interesting phenomenon is a proof that the Crust of the Earth at the surface is not generally in a state of compression.

It is impossible for me, within the limits of these papers, to go into details as to the way the folds of mountain ranges have been produced. I am compelled to refer the reader to my original work on the subject, and to the diagrams and examples therein. I may mention, however, that the lengths of the mountain folds measured along the courses of the beds and the reproduced denuded archs are, fallaceous as a test of the original lengths of the beds. In many cases the length of a bed has been increased by lateral squeezing, and often the arch has never extended over the mountain top. It has been broken and separated by the protrusion of the underlying beds.

But if expansion is produced by the rise of temperature induced by sedimentation, contraction will result from the lowering of temperature initiated by denudation. Do we find geological evidences of such contraction? will be the first question of the practical investigator. To which I answer yes; the phenomenon of normal faulting is due to contraction.

It is strange, but true, that the theorists who refer the corrugation of the earth's surface to secular contraction, pass over the difficulties presented by the existence of *normal faults* very lightly. The explanation generally offered is that they are fractures of the earth's crust produced by its sinking upon the cooling nucleus. This explanation is not very much more lucid than if we were

(1) *The Cause of Active Compression stress in rocks and recent rock Flexures. American Jour. of Science. Vol. XLI. 1891 p.p. 409-414.*

to say they are due to the "convulsions of nature" —a fraudulent explanation that used to satisfy our forefathers. The sinking of the crust, if it be an explanation of the forcing up of mountain ranges by lateral pressure, fails to explain normal faulting, which is a phenomenon of an opposite nature.

Yet normal faulting is one of the most important factors in geology. Mountain ranges do not exist everywhere; there are always extensive level and little-disturbed plains in connection with them, such as the plains of Central Europe and the American Prairies. It would however, be difficult to find a geological map in which the observer has had the opportunity of actually seeing the structure of the earth, which is not full of faults. Contorted regions, as a rule, possess fewer of these characteristic fractures than the more level plains. It may safely be said that the absence of faults in a geological map is more due to their obscuration by drift coverings than to their non-existence. Geological mappers, of course, do not put in what they cannot see or reasonably infer. In proof of this it is only necessary to point to the wonderful system of fracturing which is always delineated in coal regions, where the opportunities of examining the strata are far fuller than in other regions.

The distinguishing feature of normal faulting is that the "hade" or slope of the fault is in the direction of the downthrow. An earthslip in a cutting gives one a good notion of what has taken place, but faulting is, as a rule, sharper in the fracture and more regular. Many geologists have pointed out that it is "as if the strata had been drawn apart." If they have been drawn apart it is obvious it cannot have been done by the same cause which previously squeezed them together and ridged them up into mountains. Normal faulting is *posterior* to folding. The student of the subject may take up almost any geological section of folded strata, and he will find that normal faults cut through the folds, and that, as a rule, if the downthrow side were lifted up to the extent of the throw, the curves of the fold would be continuous.

It seems to me as plain as anything can be that the cause producing the folds could not produce the normal faults. What, then, do they result from?

The only cause we know of capable of drawing the strata apart is *contraction by cooling*. Here we have what we were looking for, namely, the effects of the sinking of the isogeotherms as opposed to the compression and mountain upheavals produced by their rise.

I have already explained that the upheaval of a mountain range by lateral pressure resulting from cubic expansion ends in the actual transference of materials to the *locus* of the range. When the internal energies have for the time exhausted themselves, and the isogeotherms sink *cubic contraction* takes place. The weight of the portion of the earth affected will allow of the existence of no cavities beyond a certain depth, consequently the strata have to accomodate themselves to the new conditions of space, which they do by shearing into wedge-like forms which, by gravitation, fit together again and close up the opening. A very interesting illustration of the truth of these principles has lately been observed and described by me. (1) A banded silty clay in the Glacial Drift at Nevin Carnarvonshire just the sort of deposit to exhibit and mark any break of continuity which might occur was divided by a system of Normal Faults reproducing in minature all the characteristics of such Faulting including the hade to the downthrow, the dropping in of wedge-shaped blocks and the occasional curve of the bands downwards on one side of the Fault and upwards on the other. These Faults were as if cut with a knife and fitted closely; the whole being like a diagram of a Faulted Coal Field. The cause was evidently loss of bulk by loss of moisture or cubical shrinkage. Substitute shrinkage by loss of heat and the parallel becomes exact. It has been pointed out already that expansion by rise of temperature under sedimentary areas was conceived to be a geological agent by Babbage, Herschell, and Scrope, but as an explanation of mountain building it was left by them in a very crude form. The dynamical effects were not fully traced, and cubical expansion was unthought of. Great praise is due to Captain Hutton for the impetus he gave to the theory by supplying elements that were previously lacking in it. I am not aware, however, of the existence of any

(1) *A minature illustration of Normal Faulting. Geo. Mag. November 1891 p. 487.*

systematic theory of normal faulting before the one broached by me in the "Origin of Mountain Ranges" (Chapter viii.) Detached thoughts on the subject there have been, and it would not be difficult to prove that glimmerings of light have occurred to many without the illumination being sufficient to allow the observer to commit himself to anything like a complete generalisation.

Those who are interested in the question will do well to read a paper by Mr. W. J. McGee, of the United States Geological Survey and in the November number of the *Geological Magazine.*(1) It is evident that American geologists are moving in the direction of the explanations of the corrugations of the earth's surface herein advocated. It is unnecessary to quarrel over the exact amount of novelty of view to be awarded to this or that investigator. If the view gains credence slowly, so much the more stable are they likely to become.

Mr. McGee says—"A primary hypothesis ascribed the corrugation of the terrestial crust to contraction of the interior of the earth, accompanying secular cooling more rapid than that of the exterior shell. The common conception of the mechanism of this process was familiarly illustrated by likening the corrugated globe to a withered apple, and the inequalities of the terrestial surface to the wrinkles on the apple's skin; and to the surprise of most American geologists at least, this hypothesis has been prominently advocated within a year or two."

No account of mountain formation would be complete without some discussion of vulcanolgy. To this phase of the dynamics of the earth I propose to devote the next article.

(To be continued.)

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(1) "Some difficulties in Dynamical Geology" p. 493. Geo. Mag, 1888.

In the Philosophical Magazine for May 1891 republished in the American Geologist. Nov. 1891, those interested will find answers to recent criticisms and some reference to the history of these ideas in "An outline of Mr. Mellard Reade's theory of the origin of Mountain Ranges by sedimentary loading and cumulative recurrent expansion."

Science Gossip.

Messers. Dulau & Co. of Soho Square London, and Mr. W. P. Collins of 154 Gt. Portland St. London have just issued their book-catalogues, in which every branch of natural science is represented.

We have to acknowledge the receipt of one of the most complete and useful works of the year.

The Annals of British Geology for 1890 is a book which no geologist can afford to be without, in as much at it contains not only a full and accurate list of the papers on geological science that were published in Great Britain in 1890, but also a critical digest and succint account of those papers together with a number of personal items bearing on the progress of science during the year. The abstract of Dr. John Murray's papers on the Maltese Islands will be of special interest to Maltese naturalists. The work may be obtained from the author Prof. J. Blake, 43 Clifton Hill, London, N. W.

In a paper on the camel, Herr Lehmann states that neither heat nor cold, nor extreme daily or yearly variations, impede the distribution of the camel,—each race of camels being, however, best adapted to the conditions of its native climate. The dromedary of the Sahara enjoys its best health in the desert, though a day of tropical heat may be followed by a night several degrees below freezing-point, and daily variations of 60° occur. In Semipalatinsh again, where camels are found, the annual variation sometimes reaches nearly 150°. But the camel is very sensitive to moisture, and desert caravans run much risk in entering regions of tropical rain during the rainy season.

Prof. Edwin J. Houston remarks that, during the general prevalence of moist warm air, a fall of rain might be produced by the sudden opening of cylinders of liquefied gases, whose expansion would cause the chilling of the surrounding air necessary to condense the moisture. The present state of meteorological science justifies these conclusions:(1) That rain can never be made to fall at will by mid-air explosions on any part of the

earth's surface, irrespective of the climatic conditions there existing.(2) That during certain meteorological conditions mid-air explosions may result in rainfall over extended areas.(3) That the liberation of energy necessary for such rainfalls is not due, except initially, to the mid-air explosion, but to the energy stored up in the moist air from which the rain is derived.(4) That the meteorological conditions which must exist for the successful action of mid-air explosives would probably in most though not in all cases themselves result in a natural production of rain.(5) That a comparatively high difference of electric potential between different parts of the air, or between the air and the earth, is possibly favorable for artificial rain-making when taken in connection with other meteorological conditions.(6) That an undirected mid-air explosion is not as likely to produce a general up-rush of air.

We have received an intimation that among the echinoderms collected by Mr. John H. Cooke in the Malta Miocene strata and sent by him to the British Museum, there are five new species, *Echinus, nov. sp., Studeria, nov. sp., Hemiaster, nov. sp., Agassizia, nov. sp., and Lovenia nov. sp.*, Mr. J. W. Gregory, F.G.S.,F.Z.S. of the British Museum has undertaken the determination of them, and will shortly publish a paper on the subject.

To the south of Algeria and Tunis there exists a great depression stretching westward from the Gulf of Gabes to a distance of about 235 miles, in which are several *chots* or small lakes, sometimes only marshes, and in many places covered with a saline crust strong enough to bear the passage of camels.

Systematic test borings in the districts of Hagenau, Zabern, Strasburg and Molsheim have resulted in the discovery in the province of immense bituminous deposits, for the exploitation of which no fewer than seven large companies have been formed to whom the whole stretch of country between Hagenau and Sulz on the one side, and Wasselnheim on the other, has been temporarily transferred. Careful examination, according to *Industries*, has shown that the petroliferous bitumen in Hagenau Forest is to be found at an average depth of 820 ft. while in the other districts the deposits have been met with at a depth of from 80 ft. Some of the companies mentioned propose constructing a net-work of private railways connecting the oil fields.

A curious application of zoölogical facts is given by M. Fallot, of Marseilles. Last June some fishermen discovered in the harbour of Marseilles a floating body in an advanced stage of decomposition. The tissues presented the transformation known as saponification and with the peculiar appearance of the skin indicated, according to standard medical authority, that the body had not laid in the water more than four months and a half. The clothing yet clung to the body, however, and was covered with barnacles. These were found to be of two successive generations, and, as they are known to fix themselves to floating objects during April and May, it was concluded that the body had been in the water at least thirteen months.

The introduction of the olive into Malta is attributed to the Greeks, who colonised the island about 700 B. C. These people,—and especially the Phocians—ousted the Phœnicians from their "pride of place" as the masters of the Mediterranean, and established colonies for themselves in the Western Basin, in Spain, Sardinia, Corsica, Southern France, and Malta, and thus propagated not only their commerce but also their arts, literature, and ideas. They have even left traces of their blood, and it is to this that the women of Provence are said to owe the classical beauty of their features.

The largest bee keeper in the world, says the *Californian*, is Mr. Harbison of California, who has 6000 hives, producing 200,000 pounds of honey yearly. In Greece there are 30,000 hives, producing 3,000,000 pounds of honey; in Denmark 80,000 producing 2,000,000; in Russia, 110,000, producing the same; in Belgium 200,000, producing 5,000,000; in Holland 240,000, producing 6,000,000; in France 950,000, producing 23,000,000; in Germany 1,450,000 and in Austria 1,550,000, each producing

40,000,000 pounds of honey. But in the United States there are 2,900,000 hives, belonging to 70,000 bee-keepers, and producing 62,000,000 pounds of honey yearly.

Vesuvius is again in activity, and the areas in the immediate vicinity have once more been subjected to earthquakes of considerable intensity. Streams of lava are flowing from the base of the Great Cone, and hot springs have burst from Mount Ossa.

At a recent influential meeting of the mayor and the most prominent citizens of Liverpool it was agreed that a Geographical Society for Liverpool should be formed.

To a commercial community like Liverpool accurate geographical knowledge such as a Society of this kind would supply means economy in, and expansion of its commerce, and therefore anything that can be done to further the objects that it has in view will greatly conduce to the prosperity of, not Liverpool alone, but also to all of those commercial communities with which Liverpool is brought in contact.

Errata: page 104, instead of 117,361 square miles, read 117,361 square acres.

An illustrated article entitled "The Scirocco as an agent of denudation with special reference to its effects on the strata of the Maltese Islands" from the pen of Mr. John H. Cooke appeared in the last number of *Science Gossip*.

Apropos of the query which appeared in our last issue having reference to the Golden Plover, Mr. S. Manchè, Malta writes, "That the Golden Plover *Charadrius Pluvialis* is very common in Malta from November to March, but the Asiatic Golden Plover *Charadrius Longipes* or *Virginiacus*, is very rare, as is also the Kentish Plover, *Charadrius Cantianus*, of which I stuffed a specimen in May 1885."

Severe shocks of earthquake are reported to have occurred at Athens on the 11th. ult.

One of the most conclusive evidences as to the true line of separation between Europe and Africa is that which is offered by the fish fauna.

We find trout in the Atlantic region and in all of the snow-fed rivers falling into the Mediterranean; in Spain, Italy, Dalmatia; it occurs in Mount Olympus, in rivers of Asia Minor, and even in the Lebanon, but nowhere in Palestine south of that range, in Egypt, or in the Sahara. This freshwater salmonoid is not exactly the same in all these localities, but is subject to a considerable variation, sometimes amounting to specific distinction. Nevertheless it is a European type found in the Atlas, and it is not till we advance into the Sahara at Tuggart, that we come to a purely African form in the Chromidæ, which have a wide geographical distribution, being found every where between that place, the Nile, and Mozambique.

"Manipulation of the Microscope", by Edward Bausch is the title of an interesting volume which we have received from Mr. W. P. Collins, Scientific Bookseller, 157 Great Portland Street, London.

Having been written by a practical man the advice which is given on the management and care of the instrument are specially good, while the innumerable hints, that it contains on the manipulation of objectives, eyepieces, and subtage illumination will render it most useful to the advanced microscopist as well as to the learner. It forms a welcome addition to the literature of the microscope.

A Correspondent "A. C." 59 Strada Levante, Valletta, Malta wishes to receive Land shells, Mosses, and Lichens from Cyprus, in exchange for Land, and Freshwater shells, Lichens, and Insects from Malta.

Editor. J. H. Cooke. B.Sc., F.G.S., Malta.

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Those of our readers who have not yet sent in their subscriptions are kindly requested to do so at an early opportunity.

To Correspondents.

All communications intended for insertion should be written on one side of the paper only; and should reach the Editor on or before the 12th of the month. Whenever an answer is required through the post, a stamped and directed envelope should be enclosed.

Secretaries of Societies are invited to forward us reports of their proceedings; and Curators of Museums will confer a favour by informing us of any new and important additions that may be made to their collections.

Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

Description of Corsica

BY

Lieut. Col. Sir R. Lambert Playfair, K.C.M.G.

Corsica has been compared in shape to a closed hand with the index finger extended, the latter being the promontory, called Cape Corse. The island is traversed in its whole length by a chain of high mountains, the general direction of which is north and south, dividing it into two parts of nearly equal extent. Placed, as it is, in the centre of the Western Mediterranean, between the Alps and the Atlas, and with so great inequalities of surface, it presents an epitome of the whole region from the warm sea-level to the Alpine character of the interior, where the mountains rise to a height of nealy 9,000 feet, and are clothed in snow during the greater part of the year.

All the western coast, and more than two-thirds of the whole island, are of granitic formation. The central range throws out spurs towards the sea, forming on the western side numerous bays of considerable size and depth. Nothing can exceed the grandeur of the scenery on the coast, which culminates in the celebrated Calanches de Piana, a succession of stupendous ranite rocks worn and hollowed out in the most fantastic manner, fearful in their forms but soft and lovely in in their colouring. There are many similar rocks throughout the island, such as the Calanches d'Evisa, the Fourches d'Asinao, and the Gorge of Inzeca, where a river flows between great cliffs and amongst boulders of green serpentine, a sight never to be forgotten.

The eastern side of the island consists of primary rocks, more or less easily disintegrated, the detritus being washed down by rains, so as to form the low plains bordering that coast. As the rivers force their way through them with difficulty, mar-

shes and lagoons are created. These are hotbeds of malarious fever in summer, dangerous even for the natives, who migrate to the hills at that season.

The forests, the great glory of the islands, consist chiefly of oak, beech, birch, and the *Pinus laricio*, indigenous to Corsica, and the monarch of European conifers, which rises as straight as an arrow sometimes to a height of 120 or 150 feet.

The Castagniccia, or country of the chestnut, is an extensive and very beautiful district, expecially when the trees are in full leaf. The fruit is more useful to the people who inhabit the district than even the date to the Arab. He has to cultivate his palm trees laboriously, irrigate them in summer, and pick the fruit with the greatest care. The chestnut demands no such attention; it grows spontaneously requires no cultivation, and the fruit falls of itself when sufficiently ripe. It is the staple food of the people, who eat it in every form, even giving it to their cattle instead of grain, while the sale of the of the surplus furnishes them with the other necessaries of life.

After the forests the most pleasing feature in the island, and covering more than half its surface, is the macchie, or brushwood, before mentioned, spreading its delicious perfume through the air and lighting up the landscape with a blaze of colour. There is also a constant succesion of wild flowers, liliaceous plants, orchids, cyclamen, and many others. In one pine wood I saw the ground carpeted with violets and primroses, while ferns, from the common bracken to the noble *Osmunda regalis*, are found everywhere.

The principal towns are Ajaccio on the south-west, a well-known winter station, the capital of the island, full of memories and memorials of Napoleon; Bastia to the north-east. the commercial capital; Calvi to the north-west, a picturesque stronghold rising high above the sea, and dominating the surrounding country. The last is one of the places that were always faithful to the Genoese cause, and it still bears over the entrance gate the inscription *Civitas Calvi semper fidelis*. It made a desperate resistance to the English in 1794 under Hood and Nelson, who reduced it almost to a heap of ruins before it surrendered. Nelson lost his eye in the engagement. A local antiquary has tried to prove that Columbus was born here, of Genoese parents, though he left at an early age for Genoa.

Corte, in the interior of the island, the ancient feudal capital, was the chief seat of Paoli's government, as well as the headquarters of the short lived English administration under Sir Gilbert Elliot. It is situated at the confluent of two rivers, the Restonica and the Tavignana, which descend to the plains through a series of magnificent gorges. High about the town, perched on the summit of a rock, is the picturesque citadel built in the beginning of the fifteenth century.

In the extreme south is Bonifacio, another ancien fortress, not only strange and beautiful in itself, but commanding fine views from its ramparts of Sardinia and the numerous islands on both sides of the strait.

Cargese, twenty-eight miles north of Ajaccio, is exceptionally interesting. In 1676 an emigration of about 1,000 Greeks from Maina, in the Morea, wearied with Turkish oppression, took place to Genoa, whence they were sent to Corsica. A second emigration of 400 started to join them in the following year, but they were overtaken by the Turkish fleet and massacred. The prosperity of the small colony was not of long duration, because, when the insurrection in Corsica against the Genoese broke out, the Greeks, out of gratitude to their protectors, refused to join in it. In consequence, their villages were destroyed, their lands confiscated, and their flocks driven away. They fled for refuge to Ajaccio, and there remained, till the advent of the French. It was one of the first acts of Comte Marbeuf, on assuming the government of the islands, to reinstate them in a new domain, and he it was who built the present town of Cargese. The inhabitants, though in full communion with the Church of Rome, still retain their Greek Liturgy, and to some extent their language, and live on the most cordial terms with their Latin neighbours.

The vendetta has always been one of the characteristic customs of Corsica, although prevailing more in some parts of the island than in others. Such feuds have been pursued with inveterate pertinacity, frequently involving whole families from one generation to another. The custom originated in times when Genoese justice was venal and corrupt,

and men had to take the honour of their families into their own keeping. After having accomplished their vendetta, the "bandits," as they are called, are accustomed to take refuge in the macchie, but they are never to be confounded with robbers, and there is no instance of strangers being molested by them.

Corsica has an important ancient history, but time will not permit me to enter into this subject in any detail. One episode, however, is especially interesting. Seneca passed eight years here in exile. A tower is pointed out on the west coast of Cap Corse which is said to have served as his prison. Even the glorious views of sea and land which it commands could not compensate him for compulsory banishment from the fertile plains of Italy. He may therefore be pardoned for his petulant injustice to the physical geography of the island when he penned his celebrated complaint, thus rendered by Boswell:—

"Corsica, whom rocks terrific bound,
Where Nature spreads her wildest desert round,
In vain revolving seasons cheer thy soil,
Nor rip'ning fruits nor waving harvests smile;
Nor blooms the olive mid the winter drear,—
The votive olive to Minerva dear.
See Spring returning spreads her milder reign!
Yet shoots no herb, no verdure clothes the plain,
No cool springs to quench the traveller's thirst
From thy parched hills in grateful murmurs burst.
Nor, hapless Isle! thy barren shores around,
Is wholesome food, fair Ceres' bounty, found.
Nor even the last sad gift the wretched claim,
The pile funereal and the sacred flame.
Naught here, alas! surrounding seas enclose,
Naught but an exile and an exile's woes."

Nor is this the place even to summarise the modern history of the island, though nothing can be more interesting than the story of the Pisan domination, the long and tyrannical rule of the Genoese, the struggle of the islanders during four centuries to regain their independence, the mock kingdom of Theodore, the wise rule of Pasquale Paoli, the unfortunate English occupation, and the subsequent conquest of the island by France.

The Fossil Whale from Citta Vecchia.

With reference to the description of the fossil whale which appeared in the *Mediterranean Naturalist*, Vol. I. No. 8. Prof. P. Van Beneden of Louvain writes, "I have read in the last number of your journal that a *Fossil Whale* has been discovered near Città Vecchia, and that several bones have been recognized. This discovery is of much interest both from a paleontological and a geological point of view. It was in Malta that the first Squalodon was discovered, and if these bones belong to a Squalodon the discovery is one of much importance.

It is desirable that these bones should be developed with the greatest care, and solidified by a naturalist.

From a geological point of view the discovery is equally interesting. This animal was, doubtless, embedded in the limestone at an epoch antecedent to the time when the Mediterranean was connected with the Black Sea by way of the Bosphorus, and with the Atlantic by way of the Straits of Gibraltar.

We can trace the existence of these cetaceans to the end of the Miocene period during which time the sea swarmed with great numbers of them, many of which often emigrated to the Kara Sea, and to the White Sea. The present cetaceans of the Black Sea are subdivided into three classes, but none of them are the descendants of the ancient families.

These three kinds have emigrated from the Atlantic Ocean, through the Black Sea; and neither the Black Sea nor theMediterranean now contain any others than these.

It is, therefore, of the gratest importance than the fossil cetaceans of the Mediterranean should be carefully compared with the living species."

Lampedusa, and its Sponge Fisheries.

The sponge beds that were lately discovered off the African coast have been the means of

giving a considerable impetus to trade among the countries and islands of the Central Mediterranean, and at the same time have caused public attention to be directed to a region that had hitherto been a *terra incognita* to all but those who lived in its immediate vicinity.

The principal centre of the trade at the present time is Lampedusa, an island which is situated on the edge of a submarine plateau that extends for a distance of about 60 miles in an easterly direction from the coast of Tunis, and which after trending to the north, connects itself with Sicily by means of a submarine ridge known as the "Adventure Bank."

Viewed from the sea on its eastern side, the island presents an undulating and low lying coast-line which is much broken up by numerous small bays and creeks, none of which, however, are sufficiently protected to serve as safe anchorages for weather bound vessels.

Falling back from the shore in gentle declivities, that are intersected by numerous ravines and valleys, the land gradually rises towards the north till it reaches the height of about 300 feet above the sea level, after which it breaks off abruptly and forms along the northern shore a line of precipitous cliffs that descend sheer to the water's edge. These cliffs continue in a westerly direction towards West Cape, a short distance beyond which they break off abruptly at the mouth of a deep and narrow valley.

On the opposite side of the valley mouth the strata again rise, and a similar, though less precipitous coast-line prevails as far as the detached rock which is known as Rabbit Island.

The numerous fertile valleys and gorges that abut on the shore, impart to it a diversified not to say picturesque aspect, and tend to tone down the harsher features of the landscape of the interior, which owing to the dearth of soil and the tropical conditions of climate render themselves so painfully apparent upon a first acquaintance. It has been computed that the island contains about 1200 Maltese salms of land of agricultural value, of which not more than 40 salms were cultivated prior to the survey that was made in the early part of the present century. Of these it was ascertained that 230 salms might readily be converted into first rate soil, 270 salms were specially adapted to the growth of forage, vines etc., and the remaining 700 salms would have served as excellent pasture grounds.

At the beginning of the present century the island was uninhabited, and as it was thought that the French might take possession of it for strategetic purposes, the British Authorities were appealed to and were induced to take it over. It was accordingly place in their hands and a small colony of Maltese was sent over to it, together with a detachment of soldiers for its protection. The sojourn of the colonists was of but brief duration; they all shortly afterwards returned to Malta, and in 1814 the island was again entirely abandoned.

The Italians then took possession, and under their care the resources of the island have been largely developed.

It is now not only a valuable emporium, but it is also the centre of one of the most thriving industries of the Central Mediterranean, and supports a population of upwards of one thousand, the majority of whom gain their livelihood by agriculture and trading.

In the summer season, however, these numbers are considerably augmented by foreigners who come for the purpose of fishing for sponges on the banks in the vicinity of the island.

It was in the year 1887 that the first evidences of the existence of the sponge beds were discovered. An Italian fisherman while trawling off the coast struck one of the beds, and further researches revealed to him the fact that considerable areas of the plateau were covered with similar deposits the sponges of which were of a much finer quality than those found in the neighbouring Gulf of Gabes, and other Tunisian sponge fishing grounds.

He at once communicated his discovery to the Italian Authorities, and from them he obtained a permit to work the beds. The news had, however, in the meantine leaked out, and upon arriving at the fishing grounds he found a score of Greek boats at work on his preserves. The dispersal of these led to further discoveries, and an extensive and profitable industry was thus established in the locality.

Operations were at first confined to the shoals near the shore, but they were afterwards extended and are now concentrated on three banks which are situated at a distance of about 30 miles from Lampedusa. One of these lies to the north-west, one to the north, and the third to the west of the island.

Of these the last two are the most frequented, as they are not only more extensive than the first, but the sponges are of finer quality, and are therefore more marketable.

During the season a strange and motley crowd assemble on and around the shores of Lampedusa. Spaniards, French, Sicilians, Maltese, Greek, and Italians engage in the work either by dredging or diving for the sponges.

Of these, however, the predominating elements are Sicilians, Greeks, and Italians.

The fishing season usually begins in May and lasts till the middle of July: but many of the boats continue operations until the commencement of the Autumnal Equinox. When a good "field" is struck the work goes merrily forward, and the boats rapidly load and return to port: but when as it sometimes happens the boats are delayed either on account of stress of weather, derangment of apparatus, or other similar causes, the time for which the crew was provisioned is exceeded, and hardships naturally follow. The life of the sponge fisher is an exceedingly laborious one, and is not unattended with considerable danger. Exposure to the powerful rays of a semi-tropical sun, the frequent and sudden changes of temperature caused by the rapid alternations of wet and dry, and the prolonged immersions are but a few of the many privations that the Lampedusan sponge-fishers have to undergo.

The boats used for the work are of the type known as the "trabaccolo." They are specially adapted for dredging as they can be readily handled, and are capable of sailing so close to the wind that the rate of sailing can be varied to any speed that may be required for the operations of casting, of towing, and of hauling the net. The average size of the boats is about 12 tons; and they generally carry five men. The net that is used for the work is of peculiar construction, and it is known among the fisherman as "la gagova," a word that has been borrowed from the Greek. It consists of a bag shaped net, made of stout hempen cord; and it is affixed to an iron frame of a trapezoidal form which serves as the mouth. The casting of the apparatus requires considerable dexterity on the part of the men, so as to insure its falling on the bottom with the right side down.

When in the sea it is towed from the end of a boom by means of a manilla rope, and the whole apparatus is so adjusted that the net is maintained in a position directly in the wake of the vessel. Should the sea, however, be rough, towing operations have to be suspended as it is only with a smooth sea and a light fair wind, that the dredge can be worked.

It is upon such occasions that the "palombari," or divers, show to the best advantage the superiority of their system over that of the dredgers.

They can continue their work long after the others have been compelled to suspend operations; and, not only can they work more rapidly, but they are also enabled to pick the finest specimens from the sea bed, and therefore the results of their labours always command the highest prices in the market.

Like the dredgers, they also use the "trabaccolo" for their work. As a rule, two men do the diving, while the other three attend to the diving apparatus; but not more than one man from each boat is in the water at the same time. They usually remain under water for periods varying from ten to twenty minutes; and they make five and six descents a day.

The machine used for the work is constructed on the "Sdebe Ermanan System," and consists of three cylinders, the whole apparatus being specially adapted for the hard wear and tear which the nature of the work that it has to do entails. The average cost of a complete diving outfit is £ 100.

The advantages that the divers have over the net-fishers is universally admitted; but the initial outlay that is required for the equipment of the former is an insuperable obstacle to its adoption by the majority of the fisherman.

As an instance of the amount of work that a diving boat can do in a season, and of the manner in which this special kind of work pays, the following items may be compared.

The boat and the machine of the divers costs about £ 160, and the working expenses for the season are about £ 240. This represents an initial outlay of £ 400. The average "take" for fifteen days work is 180 oche (225 lbs.) of the finest quality sponges, the market value of which is about £ 144. Larger boats and sometimes a steamer attend on the divers and tranship their cargoes so that the fishing boats have no occasion to leave the grounds until the end of the season, which generally lasts from ten to twelve weeks. Contrasting these items we have.

Expenditure.	£	Income.	£
Cost of Boat and Machine	160	Ten weeks "take" averaging 180 oche of sponges every 15 days @ £ 144 per 180 oche.	
Working expenses for the season	240	= £ 144 × 5 =	720
	£ 400		£ 720
			400
		Clear profit	£ 320

That is to say that each boat can clear between £ 300 and £ 400 during the season. Before it is ready for the market the sponge has several processes to go through. It is first macerated, washed, and dried after which it is clipped and sorted into various grades according to its size and quality. These processes, however, add but little to the working expenses. The majority of the sponges that come from the Lampedusan grounds are of a much finer quality than are the varieties obtained from Tunis, the Gulf of Gabes, and the neighbouring coasts. This is principally due to the marked differences that exist between the nature of the sea bottom in these districts. It has been shown that the close proximity of continental areas, and especially of river mouths is inimical to the development of sponge life, owing to the muddy conditions of the bottom that invariably exist there.

The sea bed in the vicinity of Lampedusa is of a sandy and rocky character, and it is thus specially suited to the life-habits of these protozoa. Cyprus, Rhodes, Crete, and the coasts of Syria abound with beds of varying areas; and as an example of the value of the products of this form of industry it has been officially stated that from Calymnos *alone* the value of the sponges exported exceeds the value of £ 125,000 *annually*.

There is no doubt but that, judging from the nature of the conditions under which these sponges grow, there are numerous similar beds scattered over the great submarine plateau which occupies the greater portion of the area of the southern half of the Mediterranean. The conformation and nature of the sea bed around the Maltese Islands, the close proximity of the Tunisian and Lampedusan sponge fields, as well as the more tangible evidences that are afforded us on the shores of Ghain Toffiha, St. Paul's Bay, and Melleha Bay by the numerous sponges that are cast up there after every storm afford proofs conclusive that Malta, too, has sponge-beds situated at no great distance from her shores. Enterprise and energy are all that are required to bring them to light, and if these be forthcoming there will then be no reason why, another regular and thriving industry should not be established in Maltese waters.

John H. Cooke.

The Poppy, its Cultivation and Uses.

The poppy is grown in India for opium over a region about 600 miles long and 200 miles wide. The plants come into full flower in February, when three or four feet high, and each stem produces from two to five capsules about the size of a duck's egg. Before piercing these capsules, the petals are collected, made into circular cakes from 10 to 14 inches in diameter, dried over a slow fire, and preserved for covering for the drug. In the morning it is collected in an earthenware pot, in which it is exposed to the air—but not to the sun—for three or four weeks, when the raw opium is

ready for delivery at the factory. A coffee-coloured fluid exudes from the juice during the drying, and is separately treated for the drug. The dried stems and leaves of the plants are broken up into a coarse powder for packing the drug, the oil is used for cooking and lighting, the seeds are sold as comfits, and the dry cake left after extraction of the oil is given to cattle or used in medicine.

Mediterranean Lepidoptera

(continued).

DATE	PLACE	NAME
		Acontia luctuosa
		Plusia gamma
		Acidalia sp.
		„ aversata
		„ imitata
		Pyralis farinalis
		Pyrausta purpuralis
		Etenopteryx hybridalis
		Duponchelia fovealis
		Ephaleroptera ictericana
2.6.91 and 4.6.91	Malamocco	Cœnonympha pamphilus
		„ „ var. lyllus
		Lasiommata megæra
		Pieris rapæ
		„ daplidice
		Polyommatus astrarche
		„ icarus
		Pamphila sylvanus
		Epilothyrus altheæ
		Acontia solaris
		Euclidia gliphica
		Agrophila sulphurilis
		Acidalia ochrata
		„ ornata
		Botys cinctalis
		„ nubilalis
		Pionea margaritalis
		Diasemia literalis
		Tortrix sp.
11.6.91 and 13.6.91	Trieste	Satyrus adrasta
		Hipparchia fagi
		Cœnonympha arcania var.
		Melitaea *two sp.*
		„ æetheria
		„ athalia
		„ phœbe
		Argynnis daphne
		Melanargia procida
		Aporia crataegi
		Colias hyale
		Leucophasia sinapi.
		Polyommatus adonis
		„ aegon
		„ alcon
		Thecla ilicis
		„ rubi
		Hesperia cynarae
		Zygaena hedisari
		„ transalpina
		Syntomis phegia
		Pseudoterpna cytisaria
		Fidonia atomaria
		Aplasta ononaria
		Eubolia plumbaria
		Rhodostrophia vibicaria
		" calabra
		Nemophora sp.
		Botys nubilalis
		Ebulea verbascalis
		Etenopterix hybridalis
		Eletheia carnelia
		Pterophorus pentadactylus
18.6.91	Pola	Satyrus adrasta
		Vanessa polychloros
		Argynnis cleodippe
		Aporia crataegi
		Thecla acaciae
		Etrymon spini
		Chrysophanus phlaeas
		Polyommatus aegon
		Boarmia rhomboidaria
		Grammodes stolida
		Botys fulvalis
25.6.91	Fiume	Satyrus adrasta
		Hipparchia actaeon var.
		„ fagi
		„ proserpina
		Melitœa athalia
		Argynnis adippe
		„ ino
		Pieris brassicae
		Etrymon spini
		Phodostrophia vibicaria
		Nemophora sp.
		Acidalia sp.
28.6.91	Zara	Hipparchia briseis var.
		Epinephile ida
		Melitaea sp.
		„ alpina
		„ didyma
		Gonepteryx rhamni
		Colias hyale
		Etrymon spini
		Thymelicus actaeon
		„ lineola
		Zygaena hedysari
		„ ochsenheimeri
30.6.91	Spalato	Epinephile ida
		Melitaea didyma

		Vanessa egea
		Polyommatus astrarche
		Idaea rufaria
3.7.91	Cattaro	Hipparchia fagi
		Lasiommata egeria var.
		Polyommatus battus
		,, icarus
		Thimelicus actaeon
		Zygaena coronillae
		Liparis dispar
24.8.91	Rosas Bay	Hipparchia proserpina
		Lasiommata egeria
		Deiopeia pulchella

Note:—

In cases where no specific name is given time did not admit of completing the identification: but on a future occasion I may be able to give further particulars.

P. G.

Ætna, and its Lava Streams

Ricupero observes that the lavas of Ætna do not always run with the same rapidity, but are regulated in their course by the nature of the declivity over which they flow, and by the more or less subtile or tenacious quality of the lava itself. It is not therefore surprising that some streams should run many miles in a few days, such as that in 1408, which in twelve days advanced nearly ten miles; whereas others in whole years made but little progress, for example that of 1614, which took the direction of Randazzo, but in the ten years, for which it continued running, extended to no greater length than two miles. Sometimes the same torrent differs incredibly in its velocity, thus Tedeschi says that in the eruption of 1669, the lava at intervals, ran a mile in the space of four hours, at others in four days it only advanced a few paces. In the year 1755 when two streams burst at once from the same crater, and having ran twenty four hours in succession, that which took a southern direction, had made a progress of only two hundred paces; whilst the other in the same period had reached a distance of eight miles. Massa in his "Sicilia in prospetiva" observes that the lava on being ejected is hardened immediately by the air, its surface soon looses its redness, and becomes of a black or rusty iron colour; by degrees it thickens, congeals, and takes the form of a hard stone called in common Sicilian *sciara:* but the inflamed matter still remains liquid under this crust, and being impelled by that issuing from the mouth, it pushes forward by its weight that before, and thus the torrent proceeds as long as the crater continues to throw out fresh matter. It often happens that the extremity of the stream hardens to such a degree, that the liquified lava within meets the same resistance as from a solid rock, in which case, it sometimes rises and flows over the indurated sciara as a new bed, in this manner it has been known to climb hills of a considerable height, at other times unable to force itself forward, it strikes off at an angle taking a new direction, hence the extraordinary appearance presented when the lava is observed to arrest its course on the very edge of a precipice, and, instead of pouring down its sides, to run along its verge in the guise of a wall.

J. E. S.

New Clausiliæ from Malta.

CLAUSILIA MELITENSIS C. G. nov. sp.

Whilst studying the distribution of *Clausilia imitatrix Bttg.* I noted that at *Fakkania* on the abrupt cliffs called *Rdum el Madliena* off Verdala the Clausilia of the place was rather different from the usual *Cl. imitatrix*, but being in the summer season I could only collect a few imperfect specimens from which I could not decide if they were simply aberrations of the type or not. However wishing to ascertain if all the *Clausiliæ* there assumed this local form I went again to the same place last October and I collected some good specimens, in which after examination I saw a very marked difference from the typical form. I sent them with others to Prof. Dr. O. Boettger, the celebrated specialist for *Clausiliæ*, to whom I am very much indebted for his kind assistance in my malacological studies, and he acknowledged them as a very interesting form and wrote to me saying that it was more than a variety and that it might rank as a sub-species. Having sent to him some new specimens later on, in answering me he refers

to them saying:—"In your fine Clausilia we have a quite new and very distinct species," —and as I had proposed to name it after him *oscarina* he asks me to give to it another name e. g. *melitensis*, there being already many named for him. In deference to his wishes as none of our *Clausiliæ*, though almost all peculiar to the Island, bears this name I adopt if with pleasure and following his advice I give its differential diagnosis, trusting to figure it when I shall deal with our land and freshwater molluscs in greater detail:—

CLAUSILIA *(Papillifera)* MELITENSIS, CARUANA GATTO, N. SP.

Differt a Clausilia imitatrix Bttg. cui proxime affinis est, testa profundius punctato-rimata TURRITO-FUSIFORMI; *isabellino-grisea; spira turrita; apice minus obtuso. Anfr.* 9½-10½ *planiores, ultimus planissimus, non angustatus, basi subplano distinctius bicristatus, crista exteriore longiore arcuata. Apertura distincte minor, lamella infera* OBSOLETA, *nunquam sigmoidea neque a basi intuenti spiraliter recedens, in profundo testæ fractæ* VESICÆ INSTAR PECULIARITER INFLATA. *Lunella magis profunda subventralis, brevis, lata, triangularis; plica palatatis infera* NULLA.—*Patella clausilii brevis lata, semicircularis, ligulæ instar excavata, apice acutato.*

Habitat—in insula Melita, ad loca prærupta quæ appellant RDUM EL MADDLIENA, *non longe a Verdalæ Palagio.*

Alt. 15-16½, *diam. med.* 3½-3¾ *mm; alt. apert.* 3½, *lat. apert.* 3 *mm.*—

Prof. Boettger remarks:—The patella or "trowel" of the clausilium is not sigmoid as in *Cl. imitatrix*, but semicircular and the inner form of the lamella infera in the broken shell next to the position of the clausilium is quite peculiar and has no analogy in any other known Clausilia. It looks like a sphaerical bladder and comparing it with the shape of the inner portion of the lamella infera of *Cl. imitatrix* a great diversity will be found."

I expect to go to Filfola shortly and I have hopes that the Clausilia of the rock is different from both *Cl. imitatrix and melitensis*, and even if it is not so I shall be glad to know to which of these forms those of the islet belong,—*Fielden* having already noted their remarkable size.

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CLAUSILIA OSCITANS FER. VAR. PSEUDOSYRACUSIA, C.G. *nov. var.*

This variety of *Clausilia oscitans Fer.* was until lately considered as the *Cl. syracusana Phil.=macrostoma Cantr.* It is found labeled as such in all collections of Maltese shells in Malta, it is given by *Mamo, Issel, Benoit, Gulia;* and even after Prof. Boettger's demarcation between *Cl. syracusana* and *oscitans*, *Becher* and *Fischer* in his *Manuel de conchyologie* put down the *syracusana* amongst the Maltese shells.

I must confess that on my first beginning to occupy myself with Maltese molluscs I was much puzzled by this form which being found in Valletta and its suburbs was nearer at hand and which occurred to me as being exactly like the typical *Cl. syracusana Phil.* which I collected from the ramparts of Syracuse.

On sending it to Prof. Boettger he observed that it had the disposition of its laminae similar to that of *Cl. oscitans* and that therefore it must fall under that head. But on comparing a great number of specimens of this form with others of *Cl. oscitans* from the country I came to the conclusion that all those persons who had mistaken it for the *syracusana* were not after all much to be blamed, because as it had been considered that the *habitat* of the latter extended to Malta and then meeting with this form which so much resembled it they never thought of examining it closely —and this led to the general opinion that besides *oscitans* we have the *syracusana* until Boettger clearly distinguished between them. But since it is *oscitans* it must form a distinct variety and Prof. Boettger also shared my views in this regard and favoured me with its differential characters:—

CLAUSILIA *(Papillifera)* OSCITANS, FER. VAR. PSEUDOSYRACUSIA, CARUANA GATTO. N.V.

Differt a typo testa majoore, magis fusiformi, minus ventriosa, anfr. superst. plerumque 8-9, *nec* 6-7 *dense costulatis—costis in anfr. penultimo* 35-40 *nec densissime costulato—striatis (striis* 85-105 *in typo), apert. distincte magis verticali, basi minus recedente. Cæterum et præcipue apparatu claustrali typo simillima.*

Habitat—Vallettæ apud Melitenses in rimis mœnium locisque proximis.

Alt. (decoll.) 15½-17½, *lat. med.* 4¼-4¾ *mm; alt. apert* 4-4½, *lat. apert.* 3½-4 *mm.*

A. CARUANA GATTO.

Notes on Ant's-Nest Beetles at Gibraltar and Tangier; with Especial reference to the Histeridæ.

BY

J. J. WALKER, R.N., F.E.S.

(continued from No. 8.)

After heavy winter rains, the *Sternocœli* are sometimes to be found in flood rubbish, along with a host of other beetles. It was in this way that I first obtained the then undescribed *S. fusculus*, Schmidt, on January 10th, 1888; but it was not until nearly two months later that I found one specimen "at home" with *Aphænogaster testaceo-pilosa* in the locality near the Sierra Lorca. It was in the same spot, in March, 1888, that I found *Eretmotus tangerianus*, at that time, I believe, new to the European Fauna; a few more specimens of this interesting species were obtained at the Sierra Carbonera in the spring of 1889, but it appears to be much rarer there then at Tangier. I have never seen any of the species on the wing, or travelling in any way in search of fresh quarters, as Mr. Lewis (*l. c.*, p. 294) has met with the *Eretmotus* at Tangier; but I imagine they must fly sometimes, as the only specimen of *S. acutangulus* which I found on the Rock of Gibraltar was shaken out of a dry tuft of grass on a stony slope where it could hardly have been washed down by the rain, and where there were no ants within a long distance, as far as I could ascertain.

The only other beetle which appears regularly to inhabit the nests of *Aphænogaster testaceo-pilosa* is the black *Dinarda nigrita*, Rosenh. This insect was not observed at Tangier, but it is no rarity in the Gibraltar district, half a dozen specimens being often found with one colony of ants. It is usually seen clinging to the under-side of the stone when raised, with the hind body turned up over the back, and it runs with great speed when disturbed. A fine *Aleochara (crassicornis*, Lac.) has occurred, but very rarely, with this ant at Gibraltar and Tangier, in early spring; and stray specimens of *Coloucera formicaria*, Mots., and *Thorictus gallicus*, Peyer., are occasionally met with, the latter looking, at the first glance, deceptively like a small *Sternocœlis*.

The large, powerful, and abundant and, *Aphænogaster barbara*, L., is the host of several very interesting species of *Colcoptera*, though I have never found any *Histeridæ* in its nests. The chief of these guests is the minute and very anomalous Carabid, *Pseudotrechus mutilatus*, Rosenh., which I first observed at Gibraltar in November, 1886. It is a truly Myrmecophilous insect, being invariably associated with this ant, except when found accidentally in flood rubbish; its chief resort being the sinuous galleries excavated by the ants in the soil beneath the stones, though it is not rarely seen running actively on the under-side of the stone itself. The *Pseudotrechus* seldom occurs singly, two to three specimens usually occurring in one nest, but I do not remember to have found more than half a dozen in a single colony. It is found throughout the winter months, being, perhaps, most numerous in February; and is generally, though sparingly, distributed on the clay soils near Tangier and Gibraltar, and I have also met with it at Esmir, about twelve miles south of Ceuta, in Morocco.

The singular little flat, oval, yellow Heteromeron, *Oöchrotus unicolor*, Luc. (which reminds one of a large *Leptinus*), is the most common ant's-nest beetle throughout the district, and is entirely confined to the nests of *A. barbara*, where it sometimes occurs in very large numbers, especially when there is a quantity of loose *débris*, husks of grass seeds, &c., in the galleries of the nest. With it, also frequently in some numbers, is found the little *Coluocera formicaria*, Mots.; also two species of the singular genus *Merophysia*, the smaller of which (apparently undescribed) is restricted to the nests of this ant; the large one, *M. carinulata*, Rosenh., is found also with many species of the smaller ants, always excepting the two species of *Cremastogaster*, whose sickly and disagreeable odour (recalling that of butyric acid) seems to be repulsive to insects of all sorts, and even to the woodlice so frequently found in other ant's nest. Two species of *Staphylinidæ*, *Kraatzia lævicollis*, Rey, and *Homalota elongatula*, Gr., occur somewhat sparingly in the *barbara* nests, where also I have, on one or two occasions, found *Xantholinus longiventris*, Heer, var., and the rare *Medon seminiger*, Fairm.

At Malaga, I have taken several specimens of a *Catopomorphus* with *A. barbara*, and also found a single specimen of this beetle on the summit of the Djebel Mousa (Ape's Hill), Morocco, at an elevation of over 2800 feet but the species apparently does not occur either at Gibraltar or Tangier.

Besides an occasional straggler of *Merophysia carinulata*, Mots., the populous colonies of the big-headed, pale testaceous *Pheidole megacephala*, F., appear to give shelter to but one species of *Coleoptera*, the extraordinary *Paussus Favieri*, Fairm. This beetle was found very soon after my arrival at Gibraltar, and in some localities (near Campamento for instance) it may be called abundant, as I have taken as many as twenty specimens from a single nest; it appears to be found equally on sandy or clayey soils. There is much in its general aspect which recalls that of *Claviger* on an enlarged scale, but it is an even more sluggish creature, being found motionless where the ants are most densely clustered, to them; though, as far as I can ascertain it preys on the "brood" of the ants like the *Sternocæli*. Indeed, I have never observed, with these southern ants, anything at all resembling the solicitude shown towards their Coleopterous inmates, as is exhibited by our species towards *Atemeles* and *Claviger*, for instance. The *Paussus* is found at Tangier, but is not so abundant there as at Gibraltar.

This exhausts the list of Myrmecophilous beetles which I have observed in the region of the Straits of Gibraltar; and the other ants appear to have no guests but the common *Merophysia*, with the exception of the rare and singular *Anochetus Ghilianii*, Spin., whose small colonies seem usually to be quite free from beetles. On one occasion, however, at Tangier (December 9th, 1887), I found *Pseudotrechus*, *Oöchrotus*, *Coluocera*, *Merophysia*, and *Medon seminiger*, Fairm., all out for a walk together in the warm sunshine, on the top of a stone, which covered an unusually large nest of this ant.

My best thanks are due to Mr. Geo. Lewis for the determination of the *Histeridæ*, and to Dr. Sharp for that of the remaining *Coleoptera*, also to Mr. Edward Saunders for the names of the ants mentioned in this article.

A contribution to the Moss Flora of Malta.

A List of a collection of Mosses made in 1876 by Prof. E. Sickenberger, of the Medical School, Cairo, and determined by Wilh. Baur (Karlsruhe) and Dr. C. Müller (Halle). No member of the Grimmiaceæ and Orthotnehaceæ were found.

Sphæranguim muticum, Schrb. *Valletta*, Sphærangim triquetrum, Spre. *Valletta*. Phascum cuspidatum, Schrb. *Valletta*. Phascum curvicollun, Hed. *Casal Curmi*. Phascum retrum, Sm. *Valletta; Asciak; Marsa Scirocco, Casal Curmi*. Gymnostomum tortile, Schwq. *Wied Kerda; Siggieui; Chircop*.

Gymnostomum calcareum, Ness et. H. *Marsa; Siggieui; Wied Balluta*.

Dicranella varia, Hed. *Marsa Scala*.

Fissidens Cyprius, Jur. *Vallone Misida; Wied Balluta*.

Pottia minutula, Schwq. *Casal Carmi; Corradino; Sliema; Asciak; Marsa Scala; Wied Balluta*.

Pottia minutula, *var. conica*, *Valletta*.

Pottia truncata, L. *Corradino*.

Pottia truncata B. major = P. intermedia, Fürnr. *Senglea; St Paul's Bay*.

Pottia venusta, Jur. *Corradino; Marsa Scala*.

Pottia Starkeana, Hed. *Senglea; Misida: Wied Balluta; Marsa, Sliema; Asciak*.

Eucladium verticillatum, Br. E. *Ghar Hassan—Höhle des Hassan*. Trichostomum mutabile. Br. *Wied Balluta*. Trichostomum inflexum, Br. *Makluba; Wied Balluta*. Trichostomum Barbula, Schwq. *Wied Kerda*. Barbula ambigua, Br. E. *Casal Curmi; Valletta*. Barbula aloides, Koch. *Valletta*. Barbula chloronotos, Br. E. *Valletta; Floriana* (ramparts). Barbula vinealis, Br. *Valletta*. Barbula marginata, Br. E. *Wied Balluta; Vallone Misida*. Barbula muralis, L. *Casal Gargur; Wied Balluta*. Eutosthodon fascicularis, Dicks. *Birchircara*. Eutosthodon curvisetus, Schwq. *Marsa Scala; Curmi; Siggieui*.

Funaria calcarea, Wahlb. *Marsa Scala* with Pottia venu sta.

Funaria calcarea, *var.* d. flaccida, *Vallone, Misida.*

Funaria hygrometrica, *var.* d. calvescens Schwq. *Zebbug.*

Bryum bimum, Schrb. *Wied Balluta*

Bryum erythrocarpum, Schwq. *Zeitun; Marsa.*

Bryum erythrocarpum, *var.* minor. *Marsa Scala*

Bryum atropurpureum W. M. *Corradino; Madalena Bay; Wied Balluta Wied Kerda.*

Bryum Donianum, Grev. *Wied Balluta.*

Scleropodium illecebrum, Schwq. *Wied Kerda.*

Eurhynchium striatulum, Spr. *Casal Curmi; Wied Kerda; Wied Balluta*, with Trichostomum inflexum.

Rhynchostegium tenellum, Dicks. *Makluba; Wied Balluta; Wied Kerda.*

Observations on the Geology of the Maltese Islands

BY

JOHN H. COOKE.

Proceeding now to consider the various divisions of the Globigerina Limestone more in detail, we find immediately underlying the marl, a freestone of a grey, and reddish white colour, which, owing to its close, fine-grained texture is much used for building, and other architectural purposes.

Its thickness varies from 15 to 20 feet. A phosphatic seam averaging nine inches in thickness is found underlying it in many localities, as in the cliffs at Dingli, and the outcrops along the sides of Kannotta hill, but the extent of it is not very great in either place, and the fossils contained in it are neither numerous nor well preserved.

Next in descending order is found a stratum of soft, yellowish rock of variable character.

It is very susceptible to the disintegrating action of the humid Sirocco, and it is therefore seldom made use of for building purposes when other stone is available. For the fossil hunter it is, perhaps, the best horizon that can be chosen for obtaining a representative set of the fossils of this formation. At its base lies another seam of phosphatic nodules, the majority of which consist of an aggregation of irregularly shaped masses of a brownish colour, and intermixed with them are considerable quantities of pectens, corallines, crustaceans, and the teeth and bones of sharks, the whole being firmly bound together by the foraminiferal and other calcareous matter of which the overlying stratum of rock is composed. The fossils found in this seam comprise all of the species that occur in the bed upon which it rests.

Indeed, this is characteristic of all of the nodule seams; and the knowledge of this fact will, therefore, save the geologist much time and labour when collecting the fossils of the Globigerina Bed.

Of the fossil organisms that predominate are numerous species of *pectens*, none of which have yet been critically examined, and *echinoderms*, *cephalapods* and *crustaceans*. The urchin *Brissopis crescenticus* is the most common urchin in the seam. Underlying this bed is a fine-grained freestone which, owing to its many excellent qualities, is largely used for building purposes.

The greater part of Valletta, Floriana Sliema, and the churches of Malta and Gozo are built of it. At Luca and Ta Gandia it attains a thickness of from 40 to 50 feet, but at Naxaro it thins out to 25 feet, and in other localities, notably St. Pauls Bay, it is replaced by a very inferior variety.

The stone which is taken from the quarries of Tad-dual, and Tal-Gauchi is of a yellowish white colour and is accounted among the best to be found in the island. It is, therefore, in constant request for sculptural and other decorative purposes. It has remarkable weathering properties and it is, on this account, largely used for the

facings and copings of buildings, and for capitals, vases, and balustrades. Two grave defects militate against its more extended use in high-class architectural work. The first of these is its great variability in colour, and the second is the frequent occurrence of unsightly blotches in the stone caused by the presence of concretionary nodules of hematite and ironstone. These nodules when cut through show ugly markings which disfigure the work in which they occur.

Among the men the markings are known as "*suaba*" or finger-marks, a name that has been suggested by the form that they most commonly assume.

At Tal-Gandia, and Tal Balal a fine grained, compact variety of this same bed is quarried, and is largely used in the construction of tomb-stones and monuments.

At *Inghieret*, in the vicinity of the Marsa, and also on the out-skirts of *Birchircara* there are quarries from which several qualities of this same bed are obtained, but they are all inferior to, and are, by no means, to be compared with the stone quarried from the other places that I have mentioned. Gozo is not behind either in the quantity or quality of the stone that is quarried. At Ta-Bardan in Sannat, a hard fine grained free stone of a pale yellow colour is found, which for durability and compactness is equal to the best quarried in Malta. A considerable trade is carried on in the manufacture and sale of small stone stoves or ovens called "kenur," that are in great request among the poorer classes of the towns and casals. These stoves are made of a soft-freestone, which is remarkable for the great resistance that it offers to heat. It is quarried at Tal-Taflia near Rabato, Gozo.

Considered roughly the Globigerina formation may be divided into three qualities of stone known respectively as first quality, second quality and third quality. (1)

The stone of the first quality is somewhat coarse grained when compared with the others. It is however much used for outdoor work as after exposure to the air it acquires a hardness and compactness which renders it very durable. The second quality stone, when dry, presents the appearance of being as good as, if not superior to that of the first quality. But there is a material difference between the two; a difference that is more easily discernable in wet than in dry weather.

During the wet season this stone changes its colour and readily exfoliates, and it is therefore rendered comparatively useless for outdoor work. Its brilliant white appearance and comparative durability, when dry, are qualities too valuable to be discarded, and it is therefore used very largely for interior decorative purposes. The differences of quality between these two kinds of stone are strikingly demonstrated in the exterior walls of the older houses of Luca and the surrounding villages. If examined, even in the most cursory manner, it will be seen that while many of the stones have preserved their original size and shape, others have wasted away to such an extent, that many of them are reduced to less than one half of their original bulk.

The third quality stone is of an exceedingly rotten nature and soon spilts up and wastes away. It is therefore seldom or never used for building purposes, unless it be to serve as rubbish for filling in foundations.

The thickness of the Globigerina formation is not uniform. The eroding forces that have been at work, have effected great changes in altering the original thickness of the beds in different localities and thus while at Luca and the surrounding areas

(1) By some, only the hard crystalline varieties of the Upper, and Lower Coralline Limestone are regarded as first quality rock; all of the Globigerina Limestone being classed as second and third quality.

in the vicinity the bed is found to attain its maximum thickness of nearly 250 feet, at Tigné, St. Paul's Bay, and Marsa Forno it is found to attain but from 30 to 60 feet and at St. Julian's Bay and the other localities that were just now mentioned, it thins out and ultimately disappears entirely.

The line of demarcation between the Lower Limestone and the Globigerina Limestone is often so obscure that it requires a very close examination to be enabled to trace it. As a rule the transition is marked either by a bed of urchins *Scutella striata*, or by a seam of phosphatic nodules that attains a thickness of from 2½ to 3 feet.

The nodules in this layer are of a very large size, and the phosphatised remains that are found associated with them are exceedingly numerous. The origin of these phosphatic layers which are so extensively developed in the Maltese Islands affords us a problem of unusual interest.

From the nature and condition of the remains it is evident that they are due to some great changes that must have taken place in the physical conditions of the sea, in which the organisms lived, and which, by altering the conditions most favourable to their existence, caused them to die off rapidly and leave their remains distributed in thick regular masses over the sea-bed. Large quantities of the phosphates have apparently been derived from the remains of the cetaceans, saurians, and other sea-monsters that swarmed in the sea-water.

(To be continued.)

NOTES AND NEWS.

The famous French Naturalist Professor Quatrefages has just died at the ripe old age of eight-two years.

The average height from trough to crest of the waves of the Mediterranean during severe gales is between 14 and 18 feet; but in the Gulf of Lyons the waves that are driven in by the furious northers that are so common in the winter and spring often attain a height of 33 feet.

All great eruptions of Vesuvius are stated by M. Palmieri, director of the Vesuvius Observatory, to take place at new or full moon, and especially during eclipses. On the other hand, Captain de Montessus, who has collected a record of more than 60,000 earthquakes, finds that these disturbances are distributed uniformly throughout the day and night, and that they have no relation to moon culminations and astronomical seasons.

In the course of the excavations that are now being carried out at Ortygia in Syracuse several wells were discovered, the contents of which have enabled the explorers to attribute their origin to a period between the 7th and the 2nd centuries B. C., and show that they were abandoned by the people when the city was depopulated shortly after the Roman Conquest.

A large prehistoric village was lately discovered at Arcevia in Italy, in which finely worked stone implements, stone—ware with handles, and stag-horn tools were found that evidently point to a more advanced state of civilization than is usually attributed to man during the stone age.

A "weather lexicon" has been prepared from the records of the Hamburg Naval Observatory by Herr Seemann. The days are classified by barometric pressure and wind direction, the idea being to give a collection of daily weather charts in such a form that a condition of the air over Europe resembling that for which a forecast is desired may be found. The former sequence of weather may throw some light on the coming weather.

Errata:—On page 102, "A Theory of the Origin of Mountain Ranges by Sedimentary Landing &c" for *Landing* read LOADING.

The tarantula, which is one of the largest but by no means the most venemous species of spiders found in Europe is common in Spain, Southern France, and Italy, and is found in great numbers in Apalia, and round the town of Taranto.

The female tarantula is very prolific and exercises great maternal care over her young.

She lays from 900 to 1000 eggs in the season, which are divided into two broods, one of which she hatches in the Spring, and the other in the Autumn.

Near Brunn, the capital of Moravia, important discoveries of prehistoric remains have been made, which are likely to attract the attention of palæontologists all over the globe. As a canal was being dug, four and a half skulls were brought to light of dolichocephalous (long-headed) character, and of an exceedingly low stage of development. The same place contained bones and teeth of mammoth, rhinoceros, and reindeer. Close to the skulls lay more than 500 fossil snails, several calcinous stones with holes in the middle, and a rude figure cut out of a mammoth's tooth with a hole running through the middle.

In Germany, vegetable fibre is largely used instead of animal wool for various fabrics for outer garments and other purposes. Two establishments near Breslau convert pine leaves into wool and flannels. Blankets of these materials are exclusively employed in the hospitals, barracks and prisons of Vienna and Breslau, and have the great advantage of being vermin-proof. Underclothing made from vegetable wool keeps the body comfortably warm. The shops producing these goods are lighted with gas made from the waste thrown off in the course of the manufacture.

It is a remarkable fact that, notwithstanding the voluminous literature that has been written on Birds and their habits, no writer has noticed the preference that certain species of birds give to certain trees.

Jays and rooks are found in the greatest numbers in oak-trees; Finches, in lime-trees; and Black-caps among laurels. The Nightingale is always found in the greatest numbers in nut groves, while the thrush evinces a decided preference for the birch and ash.

The beech is the favourite tree of the Woodpecker; and the numerous families of Tits are generally found in the greatest abundance among the Black-thorn.

One of the most extraordinary of the many curious natural phenomena with which the Mediterranean abounds in the "Marobia," which derives its name from "*Mare ubbriaco*", or the "drunken sea".

It is off the southern coast of Sicily where it may be viewed to the best advantage. Its approach is usually indicated by a lurid over-cast sky, and by an ominous stillness of the atmosphere.

The waters of the sea then heave, and rush up on the over-lying shores of the adjacent land, and then almost immediately retire again to their former level. During its continuance, Admiral Smyth tell us, the fish float helplessly on the surface and are easily captured. These changes are rapid and constant, and continue for periods ranging from 30 minutes, to upwards of two hours.

The "Marobia" is invariably the precursor of a gale from the southward. It is occassioned by the meeting between Trapani and Cape San Mario of a south-east wind from the Malta Channel with a westerly wind blowing towards the north coast of Sicily.

The recent researches of Pouchet during the years 1890-91, in the life-habits of the sardine have been productive of some most interesting results.

He tells us, among other things, that the sardine does not deposit its eggs on the coast, and that its eggs do not float on the surface of the water as many naturalists have stated.

During his lengthened investigations in the Bay of Concarneau Pouchet states that he never succeded in obtaining a single mature sardine's egg, and twice only, in the course of three years, did he succeed in capturing a sardine that contained a mature egg.

The experiments that have lately been carried out by Messrs. Fremy and Verneuil for the purpose of ascertaining the feasibility of manufacturing the diamond and other precious stones, have been most successful. The crystals of the diamond, ruby, emerald, and topaz, that they have produced correspond in all of their physical characteristics with the natural species.

The following prognostics of Mediterranean weather by the late Admiral Smyth, are according to my experience, so reliable that I venture to send them to you for the information of those who may not have heard of them.

Small clouds increasing prove that their weight prevents their rising in the air, and therefore denote rain; while large clouds decreasing being obviously under dissipation by solar heat, or winds assure us of fine weather. Therefore, as their ragged aspect shows the process of condensation, the cirro-stratus and nimbus clouds invariably announce rain; an uncommon twinkling of the stars denotes humidity; the rising or setting sun tinging the air with yellow, indicates vapour; and the atmosphere assuming a reddish tint, serenity. A lunar halo, coloured near her, is significant of great humidity; and a cloudless night, unaccompanied by heavy dew, betokens fine but sultry weather.

Small masses of Cumuli, with detached flaky clouds, mark settled weather and warm winds; the elegant cirrus shows approaching change, while Cumulo-Stratus with detached blackish and irregular clouds preceed variable weather, and cold winds.

Lightning near the horizon without thunder indicates wind from opposite quarter, and the same from high clouds announces fine weather. The water in part being unusually clear, so that the bottom is seen in several fathoms, prognosticates the approach of a hard gale; as does also a diaphanous atmosphere. It is, however, difficult to catch the characteristics without experience in observation.

F. M.

Mr. H. E. Craven of Matlock Bridge, England is anxious to meet with foreign correspondents for the purpose of exchanging Mediterranean shells for British land and freshwater species.

Recent experiments have shown that in the dog and the cat, as well as in the rabbit, the removal of more than three-fourths of the liver is not followed by serious consequences, and that the organ regains its weight within 36 days.

The sudden disappearance of oysters from places where they were formerly numerous may be explained by a recent remarkable visitation of the harbor of Sydney, N. S. W. The water, in places, suddenly assumed the color of blood. This proved to be due to the invasion or rapid developement of-a microscopic *Glenodium*, which in a few days destroyed half of the animals near the land, and seriously injured the oyster-beds.

Editor. J. H. Cooke. B.Sc., F.G.S., Malta.

THE

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basins are restricted in size. In such districts a large proportion of the denudation to which the surface contour of the district owes its diversified character, is to be attributed to the slow and intermittent, though powerful, agency of this wind.

It is along the escarpments of the hills and valleys, and in the cliff exposures that have a south-easterly aspect, that its powers of erosion are to be studied to the best advantage.

The flat-topped conical hills that form such a distinguishing feature in Malta and Gozitan scenery, owe their origin, in a great measure, to its influence. The Globigerina Limestone, the fourth bed from the top, forms the base of all of these hills, and on account of its homogeneity and softness of texture, it readily disintegrates before the rapid alternations of dryness and humidity that are the usual concomitants of the Sirocco.

This bed may be traced from the bottoms of all of the valleys in the Binjemma and the Gozitan plateaux, falling back in long-draw swellings and gentle undulations; and is covered with a rich and productive soil, in which the crimson sulla (clover), and the golden rye for which the islands are noted, grow luxuriantly.

Capping this bed, and still falling back in softly rounded masses are the dun-coloured marls, the taluses of which often descend the slopes to distances that are double, and even treble the real thickness of the bed. These marl outcrops are a characteristic of Maltese hill scenery. They owe their origin to the percolation of water through the upper beds, whereby the marl is rendered sodden, and then, being more susceptible to the weight of the superincumbent rock than when dry, it is pressed from out the strata, and precipitated down the hill-sides.

The bases of the hills, therefore, have a cloak of marl which effectually protects them from aerial waste, while the upper portions, being without this protective influence, rapidly waste away before the humid winds, and thus the slopes of the valleys are seldom precipitous, and the isolated hills assume a distinctly conical form.

The hills and plateaux are in this way shielded below by their own ruins, while the wasting away of the upper portions causes them to gradually assume the tapering shape with which the student of Maltese scenery is so familiar.

Unlike the Globigerina Limestone, the Upper Coralline rock is not equally susceptible to the influences of this wind. But certain portions of the strata, situated in the middle of the formation, weather much faster than do the layers either above it or below it.

In the majority of cases this formation is found capping the hills of both islands, and forming tablelands, the sides of which are bounded by precipitous cliffs that attain a height which is dependent upon the local thickness of the bed. It also forms the surface deposits of several undulating plains, and it frequently occurs as shapeless hummock-like masses. These diversities of form are due in a measure to the unequal waste that the rock undergoes, as its mineralogical composition varies considerably, some parts of the strata being so hard as to be capable of withstanding the combined action of the atmosphere for centuries, while other portions readily disintegrate on exposure.

It is to this unequal action that the formation owes the craggy contour of its cliff outlines; and it is this that causes it to offer such marked contrasts to the gentler undulations of the softer beds beneath. It is from this formation, too, that the rock boulders that strew the slopes and beds of the valleys of the islands, are derived.

The action of the sirocco and the rain upon the sand-bed that serves as the foundations of the formation, by gradually wearing it away, deprives the upper bed of its support, and causes the cliffs to break away in cyclopean masses, and to strew the slopes of the hills and valleys with their débris; while other masses are detached and are tilted so perilously out of the perpendicular that they appear—

> "As if an infant's touch could urge
> Its headlong passage down the verge."

Such are a few of the effects that this powerful eroding agent is, in part, accountable for; but it has, of course, been assisted in its work by other and equally powerful auxiliaries, without whose co-operation its efforts could not have been so effective. The main features of the country, the hills, valleys, and gorges have had their direction and extent largely influenced by the lay of the strata; while the minor ones, such as the honeycombed and fretted appearances presented by the

cliff-faces and rock-surfaces, have been influenced by the lithological characters of the rock. These are some of the assistants that have co-operated, add to which the heat and drought of summer, and the wet and cold of winter.

But effective as they are as helpers in the work of waste, no single one of them can be pointed to as being more potent, more active, more irresistible than the sirocco.

Both in Malta and Gozo the principal valleys lay in a north-west and a south-east direction; that is to say, they lie in a line with the direction of this wind.

Marsa Sirocco, an extensive bay on the east coast of Malta, so called because this wind blows directly into it, affords many striking examples of its power. It is the largest bay in the islands, and has four valleys abutting on its coast-line, each of which lies in the same direction. But it is not only in the general moulding of the country that the sirocco is concerned. Its effects may be traced in every crag and cavern, and on every rock, boulder, or other rock-surface. The irregular blocks of which the walls that serve as boundary-partitions between the fields, and the tooled stones of which the edifices in the towns and casals are built afford equally striking evidences of its power of erosion; and by their means both the rate and the amount of the denudation may by estimated. It is a noteworthy feature in the exteriors of Maltese walls and houses that the side which is exposed to the sirocco always presents a very eroded, time-worn and dilapidated appearance, whereas the other sides, in comparison, are fresh and unworn.

It is no uncommon occurrence to find the softer stones in the sides of the houses that have a south-east aspect, almost completely worn through, and surrounded by other blocks, the harder portions of which such as the fossil contents, echinoids, pectens, etc., stand out in bold relief from their worn and wasted matrices. In the old fortifications that were erected by the Knights of St. John, such phenomena as these are of frequent occurrence, and are very typical of sirocco denudation.

From a series of calculations that I have made of the rate of the erosion of the Globigerina Limestone blocks in a number of buildings and fortifications of known ages, I estimate that the rate of sirocco denudation averages $\frac{3}{25}$ of an inch per square foot per year; that is about 16 cubic yards per acre per year; or about 22 tons of material are annually wasted from every acre of surface.

In calculating this, numerous examples were taken, some being in proximity to the coast, while others were obtained from the centres of both islands. By so doing I believe I have obtained a fair average rate, for there can be no doubt, but that the rate of erosion is more rapid near the coast than it is inland. The moisture-ladened winds that sweep over the islands impregnate all that they come in contact with, and the Globigerina rock being very porous, is therefore highly susceptible to its influence.

The duration of time during which the sirocco lasts is seldom long enough to enable it to do more than affect the surface, and the period of moisture is usually followed by conditions that are diametrically opposed to those that prevailed while the sirocco was blowing.

The frequent and rapid changes that the stone thus undergoes, causes an abnormal expansion and contraction of the superficial molecules, and so tends to make the surfaces readily disintegrate and peel off in large flakes.

The work of erosion is greatly assisted also by the crystalization of the salt contained in the moisture that this wind takes up in its passage across the Mediterranean.

This moisture renders the stone surfaces highly saliferous. Under the influence of the heat of a semitropical sun, the moisture passes off, and the salt crystallizes and pushes out the superficial particles of the limestone, thus facilitating the paring down process which so rapidly wastes the rocks, and causes them to break up.

JOHN H. COOKE.

Deep-Sea Explorations in the Eastern Mediterranean.

The deep-sea explorations in the Eastern parts of the Mediterranean, which were continued this year by the Austrian Government, on board the *Pola*, were rich in interesting results; they are analysed by Prof. J. Luksch in the *Sitzungsberichte* of the Vienna Academy (vol. 100, 2nd division), and were briefly referred to in the 'Proceedings'

for December. Leaving the Adriatic at Cape Leuca, the *Pola* proceeded south to the latitude of Navarino; thence she ran south-east to Candia, visiting also Cerigo Island and Santorin. Sailing round the eastern part of Candia, the *Pola* proceeded to Alexandria, west along the African coast to Ras Milhe, thence to Candia again, along the south-western coast of that island, to Cerigo, Milo and the Pyræus. The soundings during this cruise were extremely interesting, inasmuch as in latitude 35° 44′ 20″ and longitude 21° 44′ 50″ (about 50 nautical miles south-west from Cape Matapan) the *Pola* found the depth of 4400 metres (2406 fathoms), followed within a few miles further east by a depth of 4080 metres (2236 fathoms), which are the greatest depths recorded in the Mediterranean. They have received from the Austrian Hydrographical Board the name of Pola Deep. The great depression of the Mediterranean must thus be shifted considerably east from its former central position on our maps. Another deep area was explored between Candia and Alexandria—the depths attaining from 3310 metres (1810 fathoms) some 20 miles south-east of Grandes Bay, and from 2392 metres (1208 fathoms) to 2120 metres (1322 fathoms) within a short distance from Alexandria; the maximum depth sounded being 3068 metres (1678 fathoms) in 28° 39′ 30″ north latitude and 33° 19′ 54″ east longitude. The full results of the numerous and varied observations made on board the *Pola* will be published when all calculations have been completed; but several interesting facts are already indicated in the preliminary report. The highest temperatures were found in the first parts of the voyage, and are given as follows:—From 80·8° F. to 69° in the first 50 metres (27 fathoms); from 69° to 62·5° in depths from 50 to 100 metres (27 to 55 fathoms); from 59° to 57° in depths of from 200 metres (110 to 547 fathoms) to 3000 metres (1640 fathoms). The lowest temperature (52½°) was observed at the issue from the Adriatic Sea, at a depth of 760 metres (415 fathoms); at 4400 metres (2406 fathoms) the temperature was 56°. It was observed last year that in the Central Mediterranean the density of the water and its saturation with salt increased with depth, and the same was observed in the western part of this year's cruise. But in the Eastern Mediterranean the density of water varies but very little in the different strata (from 1·0297 to 1·0300), and it is higher on the whole than in the West. The transparence of the water is very great in the Eastern Mediterranean; in three cases a white disc was seen down to a depth of 54 metres (177 feet), but it disappeared from view at a depth of 32 metres (105 feet) at the above mentioned station in the south-west of Cape Matapan. Many data relative to the colour and transparence of water in connection with the weather were collected, and they will be analysed in subsequent reports. On the whole, no less than 50 deep-sea soundings were made—27 soundings reaching depths of more than 100 metres (547 fathoms). Prof. Luksch's paper is accompanied by a map.

Proc. Roy. Geog. Soc.

Diseases of the Malta Orange.

In the reply to a letter sent by the late Major-General Hales Wilkie respecting the causes of the diseases of the Malta Orange, Prof: Tar: Toggetti of the Royal University, Florence writes. "I have the honour to acknowledge the receipt of your communication respecting the Maltese Orange pest, and having received several days later specimens of the insect of which you speak, I now hasten to comply with the request contained in your letter. First of all I find that the flies sent to me, both male and female, correspond exactly in their more prominent characters, as in their antennae and frontal parts, with other flies, which in the year 1881 were seen in Sicily and which cause considerable damage *not* to the orange cultivated there, but to the fruit of the nectarine.

I referred the specimens to the genus *Ceratites*. McLeay, (*Petalophora Macq. Tephritis Wiedm.*) and I considered it to be *C. hispanicus*, a species which was determined by Bremen from specimens brought from Spain into Italy some time before by the illustrious Ghiliani.

This species is, however, so similar to the form described by McLeay under the name *Ceratitis Citriperda* that Ghiliani without contesting the name is inclined to consider it as being a variety of the same.

This fly has been several times identified by Ghiliani as *C. capitata* (*Tephritis capitata Wiedm*), and I am also of the same opinion after the description of the figures that I have now seen.

The other, *Ceratitis citriperda* McLeay, is a species of the same genus, but of the island of Mauritius. At all events C. capitata or C. hispanica has been already found in Algeria and if the assertion of Guerin is correct it is also to be found in the Canary Islands (Madeira), and in the island of the Azores (St. Michael).

In Sicily this insect has a preference for the fruit of the nectarine, but it does not necessarily follow that in other countries it confines its attacks to this fruit alone, for in the island of Mauritius it attacks all kinds of fruit, as you have had occasion to observe it to do likewise in Malta. None of the writers whom I have consulted speak of methods of destroying this insect, or of ways by which its attacks might be rendered less destructive; and as far as I know no steps were taken in Sicily to destroy the insects that infested the Nectarine.

However, it is my opinion that great benefit would accrue by sacrificing the whole of the fruit for a year or two by collecting the oranges before they are quite ripe, and as soon as the larvae of the insects appears. As a more expeditions method I would suggest that the emulsion of Riley should be used, and with another emulsion that I warmly recommend, and which is prepared as follows :—

I.	Olio di pesce	1 parts
	Solfuro di carbonico	10 „
II.	Potassa del commercio	2 parts
	Water	10 „

Mix the No. I solution with No. II and dilute the mixture with 50 times its bulk of water.

The amount of water may be increased to any extent: and the oil and potash may be diminished, or the Solfuzo di carbonico may be diminished at will, and the emulsion even though rendered weaker will undoubtedly kill the larvae, and they may then be easily washed away either by the rain (which is very rare in Malta), or they will disappear in time, leaving the oranges free from the pest.

It would, however, be well to avoid doing this during the time when the trees are sprouting or blossoming.

Another substance which can also be used is that which is known among chemists as nitro-benzine, and commercialy as essence of mirabane; this should be diluted with water and then well shaken. Cyanide of potassium dissolved in the preparation in the proportion of one part to every 1000 of water could be also tried.

All of these liquid substances should be applied by *spraying* by means of a pump attacted to a tube at the end of which is a rose. It is necessary to be careful, however, to use a metal tube for the oily substances; and for the conducting tube a tube of metal must be adopted or a tube of cloth, but not of india-rubber.

The Americans, I think, would not hesitate to cover the orange trees with a portable tent beneath which they would develope the vapour of acido di cianidrico, obtained from the decomposition of Cyanide of Potassium, when acted on by chloric acid. The effect would be no doubt excellent but the application of it is very difficult and it is not unattended by danger to the operators who neglect the necessary precautions.

These then are the methods that I recommed to be tried. I now desire for my own information that you may be so good as to furnish me with some particulars regarding the range of the infection by the Ceratitis, either known or supposed, in the infected districts, the damages caused by it; and to forward me some specimens of the orange with the larvae. This could be best done I think by sending them in a tin or zinc box pierced with air holes; if this could not be done it would be sufficient if you were to send some pieces of the peel with the larvae, or some larvae alone enclosed in either a tin or a zinc tube."

Both for these and for other particulars relating to the diseases of the Malta Orange we are indebted to the courtesy of Mr. E. Tagliaferro, the hon. sec. of the Malta Orange Commission to whom we now beg to offer our sincere thanks. (Ed. Med. Nat.)

Theories of Mountain Formation.

BY T. MELLARD READE, C.E., F.G.S., F.R.I.B.A.

Part V.

(Conclusion.)

The relation between volcanic energy and mountain formation are undoubtedly intimate, yet the prevalent ideas on the subject are characterised by obscurity.

Unfortunately phrases so often do duty for thought, that it behoves every geological student to ask himself as he goes along whether the explanations offered of phenomena are really such, or

merely resolve themselves into involuntary attempts to elude difficulties. Among these latter I would class the notion recently resuscitated that the sinking of the great ocean basins has thrown up the marginal deposits into mountain chains. A very slight acquaintance with geometry is sufficient to show that the lateral thrust which, on the most favourable supposition, could be produced in this way is infinitesimal. Take the Atlantic as 2,000 miles wide and three miles maximum depth, what thrust could this exert on the shore lines, even if the bottom sank the whole depth in a hundred years? The depth of the inverted arch or segment is less than $\frac{1}{600}$ of the span, and would be represented by a deflection of one inch in a girder of 50 feet span: yet a deflection of this amount would probably have to be repeated thousands of times before the stability of the terminal supports of such a girder would be greatly affected. Notwithstanding this, we are asked to believe that the folds of the Appalachians have been produced by the sinking of the Atlantic bed. If the whole three miles of depression were converted into lateral thrust it would be insufficient. If, on the other hand, the holders of this theory imagine that the Atlantic bottom rests on a semi-fluid mass of molten matter, which it displaces and throws up on its margins—an assumption for which there is no warrant at all, either physical or geological—we can only say that the structure of mountain chains negatives any such an explanation of their origin.

Volcanic energy is, in my view, another form or manifestation of the forces which, under favourable conditions, give rise to the expansions of the crust of the earth, which end in the production of a mountain chain. Volcanoes are surface manifestations of this force, and any one who wishes to study the subject from this, the first point of view, had better read Scrope's classic *Volcanoes* and the interesting treatise by Professor Judd bearing the same title, published in the International Scientific Series.

There is, however, one aspect of the question which has hardly yet received the attention it deserves. It seems pretty conclusive that volcanic energy could not have continued active from the dawn of geological history unless it were connected with the central heat. Hopkin's and Lyell's suggestions that volcanoes may be fed from isolated lakes of molten rock in the earth's crust does not commend itself to my mind, unless these lakes are themselves fed from the central reservoir.

No explanation of volcanic emission which does not provide for getting the molten rock from a depth of from 20 to 30 miles is complete. In the first place, molten lava stands in the throat of a volcano in some cases 12,000 feet above the sea level, and with such a "hydraulic head," unless it were fed from some deep-seated source, the column would lift up the earth-covering of the resevoir, in the same way that a man can lift himself by blowing down the tube of a pneumatic bellows. The column of rock and the column of lava must, to maintain stable conditions, have nearly the same weight; but, if these columns be (say) 20 miles deep, the lesser specific gravity of the fluid lava will account for its emission at heights of 12,000 feet above the sea. Unless the lava, fluid at the surface, is solid or nearly solid at its origin, it seems impossible to account for the phenomenon of intermittent emission at the surface: for, were the whole column of lava fluid and fed from a fluid reservoir, gravitation of the covering rock would produce continuous emission until exhaustion took place, instead of that intermittent emission which is the regular, or rather irregular, mode in which volcanic action manifests itself.

Prof. Judd, in his report to the Royal Society on the eruption of Krakatoa, has shewn that when the mixtures of silicates of which the Krakatoa lavas consist contain water, then very fusible glasses are formed. From this fact Professor Judd infers that the slow percolation of water into rock masses from above, and the consequent formation of new compounds more readily acted upon by subterranean heat, is capable of bringing about volcanic action These interesting discoveries throw much light upon the immediate manifestations of volcanic energy, but they are surface actions, and do not account for the pumping up of the incandescent matter of the globe from below what is called the "crust of the globe." Unless there were as I pointed out at the commencement of this article, a continual renewal of incandescent matter from a central reservoir, in the millions of ages

that have elapsed since the earth became habitable volcanic energy would have died out, whereas, according to the best geologists, it is potentially as active now as ever.

It is a very remarkable fact, that frequently in great ranges of mountains the crystalline nucleus has been penetrated by igneous dykes long after the elevation of the range, and volcanic cones have been built upon the highest points. This holds good with the Caucasus, where volcanic eruptions, which took place at the close of the Tertiary epoch acccording to E. Favre, only exercised a local effect on the upheaval of the chain. The most considerable cone and the highest peak is that of Elbrous, which has arisen in the midst of crystalline rocks where the eastern part of the Caucasus reaches its greatest width. We may not unnaturally ask ourselves why volcanic action should manifest itself specially in this way, rather than that the lava should break out at lower levels? It would seem to point to the persistence of a focus, or of foci of heat, under the range, remnants of the heat energies which originally, by expansion of the heavy overlying sediments which sealed them up, gave rise to the range.

Volcanic action has, in one form or another, always been present during the building of mountain ranges. The sedimentary beds are often interstratified with lava flows of great thickness, and seemingly the combined sediments and lava sheets have had to be piled up to a great thickness before the energies necessary for mountain building have accumulated sufficiently to initiate mountain movements. That this has been the case we see a good example in our own Snowdon, where the sheets of trappean rock partake of the folds of the mountain equally with the sedimentary beds. From this it would appear that where there has been great surface emission there has not been contemporary mountain building—except in a plateau-like form, as in the Deccan in India and Colorado in North America. If, as I infer, mountain building and volcanic action are different results of the same heat energies. it follows that where there is easy surface overflow there cannot be that intense folding and crushing which are the predominant characteristics of a great mountain range.

Our direct knowledge of volcanic action is limited to surface phenomena. Mechanical knowledge almost as certainly leads to the inference that it is really deep-seated. We cannot say what takes place in the laboratory of nature 30 miles below our feet, but that variations and long pulsations of temperature take place we must reasonably suppose. We have seen that the piling up of sediments is one cause of this, but doubtless there are others we can only dimly guess at. Emission at the surface of molten lava will produce a movement of fresh magma towards the base of the column or pipe: this means a renewal or accession of heat, and it also means further chemical reaction and melting of surrounding rocks. Expansion in volume of this magma, be it ever so minute, will show in the volcanic column like the mercury in a thermometer. Doubtless there are resevoirs of lava in the solid crust itself fed from the nucleus, and an alteration of volume in the solid surrounding rock, such as accompanies a small change of temperature, will affect the lava column in the same way as an alteration of the bulk of the molten matter of the reservoir itself.

The late Mr. Mallet considered volcanic action to be due to the crushing in of the crust of the earth following upon secular refrigeration, and his theory was therefore on the same basis at the "contraction" theory of mountain formation. If, however, this theory is incapable of explaining mountain upheaval, still less can it account for volcanic action; for, as is shown by the investigations of the depth of the "level-of-no-strain" crushing ceases a few miles below the surface. Volcanic action, as already shown, is initially deep seated, and volcanoes must be fed from a zone of the earth at depths so profound as to be well within the contracting magma. Now, as contracting matter cannot force itself up to the surface, we must look to other agencies for the pushing up of the incandescent matter of the interior, which only becomes molten by the relief of pressure on nearing the surface. This force is to be found, I believe, in variations of temperature, which increase the local bulk of particular sections of the earth,

The problems discussed in this series of articles are of a very difficult nature. They demand a great variety of knowledge on the part of him who would investigate them.

First and foremost, to properly grapple with the questions that arise demands the possession of a sound mechanical instinct. A theoretical acquaintance with mechanics, though absolutely essential, is of itself insufficient. A real living acquaintance with the sort of forces to be dealt with, born of a long practical struggle with mechanical difficulties, seems to me not less requisite. Chief of all, however, is it necessary to study the phenomena of nature, not only in the field but in the works of those geologists who have devoted themselves to the unravelling of the earth's secrets. The successful investigator must sail very close to the facts of nature; he must never lose sight of them but continually square his theories with them. Nothing is easier than to elaborate a system of cosmogony in the closet, starting from some simple axiom; but a theorist of this kind very soon parts company with fact and nature, and sails off on an imaginary cruise on his own account. Like Fuseli, the painter, who is represented to have said of himself—"Nature puts me out," such a theorist draws his pictures, and eventually his facts also, from the stores of his inner consciousness. Our theories should be explanations of what we see, not *a priori* possibilities.

It is the great glory of geology that it brings into strong action common sense and sound judgment, and it has always seemed to me to be a science specially adapted to the English mind. Be this as it may, there is scope in it for the profoundest practical and theoretical knowledge.

The more we labour the more oppressive the feeling of our own inefficiency becomes; but, at the same time, if progress be slow there is great satisfaction in feeling that one has contributed a stone or two to the great cairn of truth. Whether such contributions are contained in these articles it will be for time and the labour of others to tell. The investigations upon which they are founded have, at all events, enlarged my own horizon and given me a clearer conception of some of the processes of nature; and, if this be the case, I venture to hope that others also may derive some benefit from following the same mental processes.

The Soil of the Maltese Islands.

The soil of the Maltese Islands has, from the earliest times, enjoyed the reputation of being accounted among the most fertile of any district in the Mediterranean.

The cloths made by the Phœnicians and Carthiginians from cotton grown in the islands had a world-wide repute; and the writings of Lucretius, Silius Italicus, and Cicero give us a very vivid idea of the estimation in which the cloths made in their time were held by the sumptuous Romans.

The great increase in the population of the islands in modern times, and the increasing demands that are therefore made on the soil to provide sustenance for the people, have taxed its resources to the uttermost; but as far as can be judged by the quantity and quality of the crops that are grown, its fertility is in nowise diminished a fact that is no doubt due to the inexhaustible store of phosphates and other plant feeding minerals contained in the islands' strata. Among the Maltese there is a prevalent opinion that the soil of the islands is not indigeneous, but that it was brought here from Sicily in the time of the Knights.

The incorrectness of this view will be at once apparent to all who will take the trouble to compare the composition of the soils with that of the rocks upon which they lie.

Mr. O. Chadwick writing to Dr. John Murray gives a most ingenious demonstration against the theory in the course of which he says," The theory of importation does not, to my mind, appear to be probable.

It may be that some Grand Master imported some ship-loads of soil, though no difference is to be observed between any of the lands of the order, and others in the neighbourhood. If we suppose that out of 95 square miles which form the area of Malta, not more than 10 are covered with red soil to a depth of one foot six inches then we have $\frac{10 \times 3097600}{2} =$ 15,488,000 cubic yards; at 200 cubic yards to a ship-load this gives 77,440 ship-loads, or one ship a day for two centuries all of which must have loaded at or near the same place at Marsala, where I observe that a similar soil overlies an apparently similar formation.

The assumed 10 square miles is a guess only, but the figures give an idea of the magnitude of the operation. I am not acquainted with the documentary evidence as to importation, but it most be strong indeed to be accepted.

I have observed that the Maltese have a strong tendency to adopt the most heroic and marvellous solution of any given problem."

Disappearance of Spondylus gæderopus, L. and other species from Maltese Waters.

Reference was made in the last number of the Mediterranean Naturalist anent the sudden disappearance of oysters from the harbour of Sydney where they were formerly numerous, which disappearance is due in that particular case to the invasion of a *Glenodium*. This brought to my mind a similar fact that took place in this part of the Mediterranean with the *Spondylus gæderopus L.* This *Spondylus* up to 20 years ago was a very common species here, so much so that it formed an article of food in the markets and was known in the vernacular by the name of *Gaidri*, and even 10 years ago I remember that I used to see if sold, though sparingly, in the streets. Dr. Caruana in Mamo's Catalogue, and Benoit and Galea in theirs, note it as being very common and quite rightly too. At present the only specimens obtained are poor and of stunted growth and even these are very rare and they bear but little resemblance to the fine and malgrive specimens that were formerly so plentiful and which now are never seen; if is only on the beaches that one can perhaps collect some bleached valves of them: if they continue disappearing at this rate they will in a very short period have to be accounted as an extinct species for these islands.

I may also add to the fast-disappearing *Spondylus*, the *Solen nagina;* the *Solecurtur coractatus Gmel:* known under the name of *Stocci* and which were common at Renella; and the *Purpura hæmastoma L.* which I see noted in the Catalogues of Maltese shells as common species. At the present time this does not stand good with regard to any of them and in the course of my visits to the sea fruit market and in the dredgings both of my friend Dr. Galizia and of my own we never came across specimens of either.

Whatever be the reason for this fact, it must explain the disappearance of these molluscs from every part of our shores because, the *Solen* excepted, they were not species confined to a single locality, but were widely distributed, and we have not before us a slight change in their frequency but from a degree of very frequent occurence we now find them to be almost totally extinct.

On the contrary *Dosinia Exoleta L.* seems to have been rather, an uncommon species in Mamo's and Gulia's time, while now this species is very abundant indeed, in the Great Harbour at least, where I have often, when dredging, obtained hundreds of specimens.

The like may be noted of *Ostrea lamellosa, Brocchi—Coccli* which has taken in the markets the place of *Spondylus* and which I believe has of late greatly augmented in numbers.

Apart from the causes which have led to these variations, there is nothing astonishing in these changes which are constantly going on more or less in the faunas and floras of all countries. I trust that this will not be without some interest to our naturalists.

Alfred Caruana Gatto.

Science Gossip.

The lavas of Ætna contain a considerable number of minerals, but iron is only found in a state of decomposition.

The mountain abounds in asphaltus, bitumen, and lapis obsidianus. Vitrolic and sulphurous acid are often met with; and near spots burnt by the lava alluminous schists are sometimes found. The lavas enclose a variety of precious stones such as garnets, hyacinths, and among others that noble stone the chrysolite. An ancient lava near Aci Reale yields zeolites of extraordinary whiteness.

Water spouts are of frequent occurrence in the Mediterranean at all seasons of the year but expecially so about the time of the Autumnal Equinoxes.

The opposing winds that then contest for supremacy bring together dense masses of clouds and it is when these meet that the "spouts" are usually formed. In localities like the Straits of

Gibraltar, Cape de Gat, St. Antonio, Cape Crux, the Balearic Isles & Cape Bon where the changes of wind are sudden and local currents of air are induced, these phenomena are of such frequent occurrence, that *Beete* states that he knew of a vessel that was becalmed with no less than seven waterspouts around her all of which were seen moving in different directions at the same time. The formation of two and three at once is a common occurrence.

Dwelling on the triumphs of spectroscopic photography, Sir Rober Ball mentions that the movements of the stars in a direct line towards or from us, which were not noticeable on merely telescopic examination, are now measured with wonderful exactness. It is to the spectroscope also that we are indebted for putting the measuring tape round the girth of a star. Stars at such a distance that if they were brought ten times nearer us would still be too far away for measurement by the ordinary processes of the observatory, have now their diameter guaged. Of the dark satellite of the variable Algol so much has been deduced that Sir Robert is able to say: "Here is an object which we never have seen and apparently never can expect to see, but yet we have been able not only to weigh it and to measure it, but also to determine its movements."

Grape-stones *Industries* informs us are now being made the subject of a series of chemical investigations for the purpose of ascertaining to what uses they can be put. The result has been to show that the oil is by no means dissimilar to castor oil, resembling that substance in its high acetye number and iodine number, a resemblance which extends to its property of yielding Turkey red oil on treatment with sulphuric acid. Direct dyeing tests have shown the value of the discovery. The confirmation of this result will, no doubt, give rise to a lucrative industry.

At the last annual dinner of the Meteorological Society Mr. G. J. Symons said he had observed that meteorological observations seemed to have a wonderful effect in promoting longevity; and in proof of his statement, said that the average age of observers in correspondence with him was nearly 70 years.

As our readers probably know there is a large army of private individuals who undertake such observations as a labour of love, and who regularly report to the central authority. We are glad to learn that the work is so conducive to long life a fact which cannot fail in securing many others willing to make records on such favourable terms.

A very singular manna-like substance, says the *Scientific American* is that known as "Trehala" in Syria and as "Shuggar Tigal" in India.

These have been considered as distinct products though closely allied. The so-called manna consists of oval shaped cases, averaging $\frac{1}{2}$ inch to $\frac{3}{4}$ inch in length, externally rough and irregular, hard and brittle, of a grayish white color and with a sweetish taste.

These cases are found attached by one side to twigs of a species of *Echinops* in Syria, and are constructed by a small beetle which has been described as *Larinus subrugosus*. The larva of this insect collects a considerable quantity of saccharine aud amylaceous matter from the *Echinops* and it constructs its dwelling by disgorging this matter and moulding it in the form to cover itself. Each case contains one insect only, and when this has attained its perfect form, emerges at the upper end. Analysis of these peculiar cocoons or nests has proved them to contain gum, starch, and sugar. Placed in water at an ordinary temperature they swell, partly dissolve, and become converted into a pasty mass. They are collected in Turkey and Syria, and used as food, and they are also exported in quantity to Constantinople and other Turkish cities.

The glaciers of the Alps, according to Herr von E. Richter, are now showing marked indications of increase in size, after having been, diminishing quite rapidly for about 30 years, with the exception of a transitory extension about 1875. From the historical records of about three centuries, it appears that the glaciers have had alternate periods of growth and diminution. In this time no less than eight marked epochs of growth can be traced, the first having begun in 1592, and the last, excluding the slight one of 1875, in 1835,—each having been followed by a period of glacier retreat. The intervals between the epochs vary from 20 to 47 years.

The second number of the "Rassegna delle Scienze Geologiche in Italia" has come to hand and its contents are quite as interesting and as valuable as those of the first number.

Besides the brief digests of the papers on Italian geology, that were published during the year 1891, there also appears the continuation of Prof. A. Goiran's paper on the Veronese earthquake of June last, and a short paper by Sig. Pietro Zesi on the travertine and the water in the neighbourhood of. We again recommend it cordially to our readers notice.

It is now the humble earthworm, exalted by Darwin to the position of the soil-tiller's benefactor, that is destined to become the dread of nervous folk. Pasteur showed about a dozen years ago that the bacterium of charbon may be taken up from corpses by these creatures, and carried for a considerable time in their bodies. Two other French biologists, Lortet and Despeignes, have since experimented on the line thus suggested, and have satisfied themselves that these animals can become the hosts for months of the tubercle bacillus, which loses none of its virulence by its change of abode. It is thus possible that earthworms—so universal and so active—may become the means of spreading one of the most terrible scourges of mankind. The work of these experimenters has a further interest in being the first recorded demonstration of the "tubercularization" of an invertebrate.

The Tunisian Locust Plague.

Some interesting notes bearing on this subject appear in the current number of the "Garner." in the course of which the writer informs us that *Acridium peregrinum* is the name of the locust which invaded Tunis last year. The eggs hatch in from 25 to 40 days. For the first 5 days after being hatched the larval locusts are collected in large masses on bushes and plants; they are then easily destroyed by crushing or burning. They are at first grey then black, and then greenish. On the sixth or seventh day after being hatched the immature locusts commence assembling for their migratory march. They are only able to crawl in this stage of their existence, and at first progress at the rate of about 60 yards an hour; subsequently they march at a more rapid rate.

This crawling stage lasts for from 45 to 50 days, and then the immature locusts turn reddish, and attaching themselves to leaves assume their full metamorphosis.

In the past year the locusts first appeared in February flying from the south in a northerly direction. In April they reached the agricultural district in the vicinity of Susa where they settled in enormous numbers, depositing their eggs among the olive plantations where the ground was particularly favourable for the purpose. On the thirteenth of April the locusts took to wing again and went across the large cultivated plains of the Engida, in Käurwan, and then on to the wooded and rocky hills of Zaghoum where the largest egg deposit took place.

In May they were on the rice plains to the north of Zaghoum, and the environs of Tunis and Bjesta were invaded by large flights which left considerable deposits of eggs.

The Government granted £ 4,166 to defray the expenses of their destruction. The method found most effective was drawing screens made of cotton texture bordered by oilcloth across the line of march, and twenty-five miles of those screens were used and by their means the streams of young locusts were diverted into trenches dug for their reception lined with zinc, out of which they were unable to crawl. A mixture of sixty parts of creosote oil to forty of water was used for asphyxiating them, and was found the most effective for the purpose.

In dealing with the mature swarms the beating of tin cans by a regiment of soldiers was found an effective way of scaring them from the crops.

Samos. Its Fossils and their Age.

Mr. C. E. Forsyth-Major gives us some interesting notes bearing on the history of the prehistoric Mediterranean in his paper, "Sur l'age de la faune de Samos," which was published in November last in the "*Comptes rendus hebdom de l'Acad. des Sciences* CXIII. p. 708. The author there informs us that of 43 species of mammals found in Samos, 25 are found in Pikermi, 7 in Baltavar, 7 at Mt. Lerberon, and 13 at Maragha. From

this he concludes that the strata of these islands are of the same age. The fauna can be traced over an area extending from Spain to Persia, and it affords evidences of the former presence of continental areas in the Mediterranean. On the question as to what division of time it belongs to, geologists and paleontologists are not agreed, for while some would assign it to a period intermediate to the Miocene and Pliocene, others strongly support the view that it belongs strictly to the Pliocene.

Fuchs states that the marine shells of Raphina are of the same age as the bones of Pikermi among which they are found, and therefore he does not consider that there is any need to have recourse to a later period.

The general opinion that the upper fauna of Siwalik was contemporaneous with that of Pikermi has done much towards causing it to be considered as being of Pliocene age. To the author, however, it seems evident that it was even more recent than that and in support of his contention he mentions among other things the fact that the two faunas have not a single species in common.

The following is a list of the remarkable fauna discovered by the auther in the island.

CARNIVORI.
Machairodus. sp. Felis neas. Major.
Lycyæna Chæretis. Hens.
Hyæna eximia. Roth.
Ictitherium Orbignyi. Gaud.
„ *robustum.* Gaud.
„ *hipparionum* Gaud.
Mustela palæattica. Weith
Promephitis Larteii. Gaud.
Meles maraghanus. Kittl.

GIRAPHIDIS.
Samotherium Boissieri. Maj.
Palæotragus Rouenii. Gaud.
Helladotherium Davernoyi. Gaud.

CERVIDI.
Dremotherium (?) *Pentelici.* Gaud.

EQUIDI.
Hipparion mediterraneum. Hens.
„ *minus* Paolow (?)

ANCILIPODI.
Chalicotherium Pentelici. Gaud.

ROSICANTI
Acanthomys Gaudryi. Dames.
Remains of tortoises and of birds.

ANTILOPIDI
Palæoryx Pallassii Gaud.
„ *rotundicornis.* Gaud.
Protoryx Carolinæ. Maj.
Protoryx longiceps. Maj.
„ *gaudryi.* Maj.
„ *Hippolite.* Maj.
Helicophora rotundicprnis. Weith.
Gazella desperdita. Gaud.
„ sp.
„ sp.
Prostrepsiceros Woodwardii Maj.
„ sp.
Palæoreas Lindermayeri. Gaud.
Tragoceras Valinciennesi. Gaud.
„ *amaltheus.* Gaud.
Criotherium Argalioide. Maj.
Capra sp.

SUIDI.
Sus erimanthius. Roth. et Wagns.

RINOCERONTIDI.
Rh. chygnathus. Wagn.
Rh. Schleiermacheri. Kaup (?).

PROBOSCIDIANI.
Mastodon Pentelici. Gaud. and Lart.
„ *Turicensis* Schinz.
Dinotherium sp (?)

The Meteorology of the Maltese Islands.

The geographical position of Malta, and the transluscence of its atmosphere for the greater part of the year render the island specially suitable as a station for observing and registering the meteorological phenomena of the Central Mediterranean. Prior to the establishment of the observatory at St. Ignatius College, St. Julians, no attempts seem to have been made to carry on a regular and systematic series of observations, and science is therefore greatly indebted to the Jesuit Fathers under whose direction the observatory was originated and is now being maintained for the very valuable results that are daily recorded in their College observatory.

From the summary of the observations made by the Rev. J. Scoles, S. J. during the year 1891 we extract the following interesting items.

The highest temperature was recorded on the 8th. of June when the thermometers indicated a temperature of 155·7° Fah. in the sun; while the lowest reading taken on the 25th. of January was 32·5° Fah. On the same day the standing water on the Marsa was frozen over, and on the 19th. of January snow, (not hail nor sleet) fell at Notabile and Dingli for a period of 8 hours. January 1891 was the coldest month that had been experienced for 10 years. Thunderstorms pased on 13 days; lightning was seen on 20 days, and hail fell on 14 days.

The variations in the range of the temperature extended from 56° Fah. in January to 82·5° Fah. in August. No rain fell during the months of July and August; and during May, June, July, August, and September the total number of days upon which rain fell was but 9, and then it averaged but 0·185 inches per month for the five months.

The greatest range of the thermometer was on June 6th. when it was 35·9° Fah.

The total rainfall for the year was 17·2 inches a result that closely approximated to the average for the previous five years which is recorded as being 17.6 inches. The total number of miles of wind that passed over the islands also followed the normal curve, 82,648 miles being indicated against an average per year of 83,144 miles for the period extending from 1886—1890.

The Maltse Fossil Echinoidea.

The Maltese Fossil Echinoidea and their evidence on the corellation of the Maltese Rocks by J. W. Gregory B.Sc., F.Z.S. of the British Museum (Nat. Hist.), communicated to the Royal Society of Edinburgh by Dr. John Murray.

In the year 1855 a paper on the Fossil Echinoderms of the Maltese Islands was written by Mr. T. Wright and published in the Ann. Mag. Nat. Hist; and again in 1864 another paper on the same subject was published in the Quart. Journ. Geo. Soc. with additional notes by Dr. Leith Adams.

The great progress that has been made of late years in the study of the allied continental faunas has rendered a revision of the Maltese Fossils desirable and at the suggestion of Dr. John Murray who visited the islands in 1889—1890, Mr. J. W. Gregoryof the British Museum undertook the work and has just published the result of his investigations in a memoir bearing the above title. From an examination of Dr. Wright's types, and of collections lent by Earl Ducie, Sir A. Geikie, Dr. Woodward F.R.S. and Mr. J.H. Cooke the author records 46 species in all, of which 23 are peculiar to the Maltese Islands, and 14 are new.

The following is a list of the new species, the majority of which were found in the "Cooke Collection."

Species	Author	Up. Cor. Limestone	Greensands	Clay	Globigerina Limestone	Lower Cor. Limestone
Cidaris oligocenous	Greg					×
Echinus tortonicus	Greg	×				
„ tongrianus	Greg					×
Heteroclypeus hemisphæricus	Greg		×			×
„ subpentagonalis	Greg		×			
Breynella equizonata	Greg					
Echinolampas manzoni	Greg				×	
„ posterolatus	Greg				×	
Hemiaster vadosus	Greg				×	
Pericomus coranguinum	Greg				×	
Brissus depressus	Greg	×				
Metalia melitensis	Greg				×	
Sarsella duncani	Greg				×	
„ anteroalta	Greg				×	

Though this proportion of pecular forms is very high, he assures us that all of them are distinct species and that the differences between them and their nearest allies in the beds of the surrounding areas, are well marked. The same feature is noticeable in Corsica where, out of 45 species, 21 are found in that island only, and again in Tuscany where M. de Loriol found 8 new species, 2 only of which are known to occur elsewhere. This localization of distinct species in such limited areas as Malta, Tuscany, and Corsica the author considers to be due to local subsidences by which basins were formed that were separated from one another by shallow waters.

The difficulties in the way of correlating the Maltese beds he admits are great on account of the distance at which the islands are situated from the mainland, and owing to the want of knowledge of the island invertebrata for, with the exception of the echinoidea and the foraminifera, little or nothing has yet been done in this direction. He does not accept Dr. Wright's evidence as many specimens from Egypt and Sicily seem to have been incorporated in the Maltese collection, and many errors in specific determinations and geologic horizons have necessarily arisen. A table showing the sequence of the Maltese Rocks is then given (see Med: Nat: No. 6 1891), and the evidences afforded by the Echinoids are summed up.

Comparisons are drawn between the Maltese rocks and those of the Tongrian division of the Calabrian formations, and similar deposits in France.

The characteristic urchin of the Tongrian is *Scutella striatula.* Marc. de Serr. and specimens of this species are found in enormous quantities in the upper division of the Malta Lower Coralline Limestone. *Echinus tongrianus.* Greg. which is

also abundant in the Malta bed has for its allies *E. biarritzensis*, Cont. from the Tongrian of the Calcaire à Asteriés in the south of France, and the Vincentin beds. The conclusion, therefore, that he arrives at is that the Malta Lower Limestone is certainly of Oligocene age, and most probably Tongrian. The occurrence of considerable quantities of *Clypeaster altus*, and its numerous varieties *C. pyramidalis*, *C. portentosus*, *C. alticostatus*, *C. turritus*, and *C. tauricus (?)*, and the equal abundance *C. marginatus* established beyond a doubt the synchronism existing between this formation and the Helvetian stage of the Calabrian of Sicily. The Upper Coralline Limestone may, with equal certainty be assigned to the Tortonian both on account of its superposition to the "Greensands" as well as owing to the similarity that exists between the fossils found in it with those found by Herr Fuchs in the Leith-Kalk of the Vienna Basin.

The Globigerina Limestone and the Blue Clays would then obviously belong to the Aquitanian.

In corellating them with this stage several difficulties have to be overcome. For instance, we are told that in the Aquitanian of Reggio although the same *genera* of echinoids occur such as *Pericosmus*, *Spatangus*, *Sarsella*, etc., yet not a single one of the Maltese *species* is to be found. Between the Zone à Pecten bonifaciensis of the Aquitanian stage of Corsica, and the Schlier of Vienna differences also exist; but on the whole the resemblances to the Maltese fauna are more marked in these than they are in the Sicilian beds.

From a consideration of the dual affinities that the Globigerina fauna bear to the two groups of species found in these beds, and which have the characters of faunas of different depths the author concludes that the equivalents of the Malta beds stand thus:—

applied to the rocks in the greater part of the eastern Mediterranean.

Herr Fuchs the Vienna geologist is a strong supporter of Süss's classification, and he has shown that it can be applied over an area extending to Greece, Asia Minor, Malta, and Northern Africa.

Fuch's views are borne out by the researches of Karrer in the Vienna Basin, Manzoni in Italy, and Mazzetta in Romagna. His conclusions are that the Leith-Kalk is the littoral representative of the Badner Tegel, that the Schlier along the Appenines is the deep sea continuation of the Molassa Marmosa and the Molasse Serpentinosa, and that the Astian in Sicily is the shore deposit of the Zanclean. Amid the Mediterranean Miocene he has therefore, worked out the same principles which Prof. Lampworth had applied with such brilliant results to the southern uplands of Scotland.

Herr Fuch's labours were confined to the Central Mediterranean. Andrusov applied the same principles to the eastern portion, and to the Crimea. In the "Black Clay with Meleta" he found *Pecten denudatus* and other fossils characteristic of the "Schlier," and in the overlying limestone he recognised a stratum corresponding to the "Mediterran Stufen." Prof. Süss afterwards summarized these results in his essay on the "Mittelmeer," and Prof Neumayer also gave a sketch on the same subject.

In the western Mediterranean Süss's system has not met with such a ready acceptance.

The classification worked out by Professor C. Mayer in Liguria has there been adopted and has been applied, in France, Spain, and Algeria: and even in the Vienna Basin it has supporters. Fuchs showed that the Maltese rocks agreed with the Austrian series, but Mr. Gregory in inclined to go but a portion of the way with him, for as the Maltese area was situated on the border-line between the two areas the strata therefore assume two diffe-

Corsica.	Malta.	Vienna Basin.	Series.
Zone à *Pecten bonifaciensis*	Lower Globigerina Limestone	Sotzka Schichten	Aquitanian
	Upper „ „	Horner „	Langhian
Zone à *Pecten cristatus*	Blue Clay	Schlier	
Zone à *Cerites et Pleurotomes*	Greensand	Grund. Schichten	Helvetian

Not the least interesting part of this memoir is the summary of the evidences that the echinoids afford us for correlating the Malta beds with those of the mainland.

He points out that the Miocene deposits of the Mediterranean have been classified upon two different principles, the most generally accepted of which is that of Prof Süss who showed that the Vienna sands and limestone are shallow water beds, and that they are separated by a deep water deposit. To the former he gave the name "Mediterranean Stufen," and the intermediate bed he called the "Schlier." His classification has been

rent sets of characters, some of which agree with the characters of the one half and some with those of the other.

The occurence in the Malta beds of two groups of echinoderms so widely different in their habits and characters he attributes to the fact that the Maltese area was then situated on the border line which divided the Mediterranean into two parts, each of which greatly differed from the other in its physical aspects and conditions. The alternate elevations and despressions to which the Maltese area was subjected led to corresponding changes in the fauna; the shallow water forms from the northwest

thus became intermixed with the deep-water forms that migrated from the eastern basin, and when the elevation became permanent the deep water forms finally left the Maltese area for the Adriatic and left the shallow water ones in undisputed possession.

The memoir has two plates appended containing illustrations of 10 of the new species that Mr. Gregory has added to the Maltese Echinoidea.

Mummy Wheat.

The land of the Pharohs is still a wonderland to western civilization, and the many archeological discoveries that have been made of late have still further served to increase the veneration with which it is regarded. Any relic, from a fragment of one of the pyramids tothe skull of a mummy cat, or indeed one of the fossil Pharohs themselves is eagerly sought after and carefully cherished by the fortu nate finder. Considering, therefore, the great demand that there is for relics of this description it is no wonder that when the legitimate supply fails to meet the demands of the market, that illegitimate means should be employed to supply the deficiency. Of these frauds the so called Egyptian mummy wheat is perhaps one of the most bare faced of the many impostures that are practised on the unwary Nilian traveller.

Prof. Henslow gave an interesting article on the subject in Nature Notes 1890 and now Mr. Carruthes F.R.S, has delivered a lecture on the same subject in the course of which he tells us that the extreme life of a grain of wheat was twelve years

He had tested this by experiments, and many others had done the same, so it was quite certain that they could not grow a seed of wheat after this period had elapsed. . . . . Of course, this cut at the root of all stories about mummy wheat. It was quite certain, as had been clearly established again, that no seed which was buried with the mummy at the time it was put in the coffin had ever germinated. It was not only the examination of the seed that would establish that; experiments had been made to show that this was not the case. He himself had examined a large number of seeds in the British Museum, taken from mummies, and they were all in the same condition that the mummy itself was in. It would be impossible to stretch out the arm of a mummy, because the whole of the muscle was entirely burnt up by the oxygen, and it was completely rigid. It was so with the whole of those grains of wheat, and flax, and various other seeds that were preserved—they were in the same condition. They had been subject to the slow burning action of the oxygen, and the whole of their vitality had disappeared. With regard to what was known as mummy wheat, it was only a form of corn that was still extensively cultivated on the southern shores of the Mediterranean, and was easily obtained from Arabs and others, who were always ready to impose upon travellers, who brought it home, as true mummy wheat.

NOTES AND NEWS.

A method of purifying water invented by Dr. Wm. Anderson, and successfully used at Antwerp, consists in passing the water through a revolving cylinder containing metallic iron in the form of scraps or filings.

We have much pleasure in acknowledging the receipt of a copy of the address which was delivered by Dr. R. Bowdler Sharpe, LL.D., F.L.S. before the second international Ornithological Congress.

Tunis is being rapidly developed. The exploitations that have lately been made have resulted in the discovery of metalliferous deposits of considerable extent. Lead, zinc, and iron are the most abundant and already four lead mines, and one iron mine are at work. Silver, quicksilver, and copper have also been found in veins, and gold is found in the sands of several of the rivers.

Sawdust is one of the last things that we should have anticipated being utilized in the construction of our dwellings. *Engineer* however informs us that a German firm has perfected a plan whereby sawdust may be made into bricks of extreme hardness and durability. The sawdust is mixed with acid, and afterwards moulded and compressed. The material thus prepared is practicably non-combustible.

Lampedusa.—Erratum Corrige.

In the article on Pantelleria inserted in the December number of the *Mediterranean Naturalist*, I must apologize for having made an erroneous statement in saying that *Lampedusa is a volcanic island*, whereas it consists exclusively of Upper tertiary sedimentary rocks. The error will be found in Gatto's book: *L'Italia: suoi Vulcani e Terremoti*. I did not discover the mistake in time, but seeing the Scientific importance of this journal, in order not to propagate error, I

should feel much indebted if suscribers would kindly strike their pens through the two words: *and Lampedusa* (page 95, Column 1, line 36.)

T. Jervis.

Alluding to the rapid rate at which the sparrow propagates its species a correspondent in *Nature Notes* informs us that a short time ago the authorities of a western city imported 5 sparrows to rid the cotton plantations of the caterpillar plague, and that in the course of three years their progeny had increased to five millions.

According to a recent consular report there are no minerals or metals of any consequence at present mined in Pomerania, with the exception of small quantities of ironstone and a little salt. Lime is found on the Dievenow River, and the Island of Rügen has inexhaustible beds of chalk. Brown-coal pits have been opened at Podejuch, on the northern edge of the Bahn plateau; in the Valley of the Oder at Dahlow, Trampke, and in the western part of the lake district; and on the shores of the Baltic at Zaskenzien, in the district of Lauenburg.

One of the finest climates in the world is that of Tunis. Its air is pure, serene, and wholesome, the thermometer ranging in general from about 45° to 87° Fah. with an average mean temperature of 68· 5°. With rare exceptions the revolutions of weather range between are 29·10 and 30·30 inches. The cloudless skies that sometimes last for weeks together are often wearisome enough to the regular resident and give much point to the little anecdote which the late Admiral Smyth relates of Captain Fothergill. This eccentric officer was returning from India, where he had served for years. Coming on deck when the vessel was entering the English Channel on a foggy November morning, he turned to the lieutenant of the watch and exclaimed. "Hah! this is what I call something like.

None of your cursed eternal blue skies here,—a fellow can see his own breath now."

Apropos of sunshine, the sunshine recording instrument at St. Julians, Malta has registered (reckoning a completely over cast sky as 10) 3·9 as the average mean amount of cloud in Malta for 1891. That is to say that the inhabitants have enjoyed 61 per cent of the highest possible amount of sun-shine. The average for the previous 5 years was 66 per cent, and in no single month has it been less than 40 per cent. What a contrast is not this to the results recorded at the Observatory at Bunhillrow, London.

No sunshine was registered in either December, 1884, January, 1885, or December, 1890. Greenwich only secures 25 per cent of the total duration, while Kew Observatory has but 28 per cent.

From observations of the displacement of the lines of the solar spectrum, Prof. Duner, a Swedish astronomer, has been able to measure the rapidity of rotation of the sun with an exactness hitherto unknown. He finds that that part of the surface travels round the axis at the rate of a little more than a mile a second, the solar day at the equator being equal to 25 days and 12 hours of our reckoning. A remarkable fact possible only with bodies having a movable and gaseous surface—is that the rotation varies in different parts of the sun, diminishing regularly from the equator toward the poles. Near the poles it requires about 46 of our days.

Books etc. received.

"*Sul Granito dell'Isola del Giglio*" by Prof. R. Meli, Rome.

"*Elenco Bibliografico delle più importanti publicazioni dei manufatti e specialmente delle terre cotte*" by Prof. R. Meli, Rome.

"*A review of recent attempts to classify Birds*" by R. Bowdler Sharpe L.L.D., F.L.S. etc.

"*The Canadian Record of Science.*" Vol IV. No. 8.

"*Sopra La fauna del così detto "Schlier" nel Bolognese e nell' Anconitano* by Dott. Vittorio Simonelli, Pisa.

"*The Maltese Fossil Echinoidea and their evidence on the correlation of the Maltese Rock's* Vol. XXXVI. part III. No. 22 Proc: Roy: Soc: by J. W. Gregory B.Sc., F.G.S., F.Z.S.

"*Scientific American*" March 1892, New York.

"*Mining and Engineering News*" March 1892. New York.

"*Neptunia*" by Dott. D. Levi Morenos, Venice.

"*Rivista Italiana di Scienze Naturali*" March 1892 by Sigismondo Brogi, Siena.

"*Bollettino dei Musei di Zoologia*" della R. Università di Torino. Vol. VI. Nos. 94-111.

"*The Naturalist*" by W. Denison Roebuck F.L.S. March 1892.

"*The Channel Islands*" by Dr. Lorenzo G. Yates F.L.S., F.G.S.A.

"*Rassegna delle Scienze Geologiche in Italia*" by Messrs. M. Cermenati, and A. Tellini. Dec. 1891. Rome.

"*The Nautilus*" by H.A. Pilsbry, Philadelphia. A monthly devoted to the interests of conchologists, One dollar per year.

"*The Canadian Record of Science*" Vol. Nos. 1 to 8.

"*Results of Meteorological and Magnetical Observations* for the year 1891. Stonyhurst College Observatory.

Editor. J. H. Cooke. B.Sc., F.G.S., Malta.

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Subscriptions are now due.

Special Notice to Readers.

Those of our readers who have not yet sent in their subscriptions are kindly requested to do so at an early opportunity.

To Correspondents.

All communications intended for insertion should be written on one side of the paper only; and should reach the Editor on or before the 12th of the month. Whenever an answer is required through the post, a stamped and directed envelope should be enclosed.

Secretaries of Societies are invited to forward us reports of their proceedings; and Curators of Museums will confer a favour by informing us of any new and important additions that may be made to their collections.

Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

Diseases of the Malta Orange.

Introduction:—The insects with two membranous wings known as Dipterans offer to the study of the Naturalist various families with a prodigious number of species many of which infest man in his dwelling, such as mosquitoes and flies, while others torment domestic animals as the tick which is found on sheep and cows and the gadfly on cattle.

Several of these insects are likewise pernicious to the vegetable kingdom, consuming leaves, flowers, and fruits.

The peach, cherry, and olive, besides other trees are specially attacked by flies, the larvae of which devour their fruits; thus proving very detrimental to the cultivators of fruit-trees.

The orange trees, especially the mandarines are attacked by a lively, small fly known to Zoologists for the last sixty-three years. This fly seems to have first visited this Island about fifteen years ago, since which time, it has gradually increased in number causing damages which during the last three years have become most serious.

This insect belongs to the "Ceratitis" as classified by McLeay in the year 1829.

Men who claim the right of priority call this species "Ceratitis Capitata". Wiedmann, a few years before, described the same Diptera as "Tephritis Capitata"—however the insect still continues to the known by English entomologists as "Ceratitis Citriperda"—as thus designated by McLeay.

This species has for a long time been confused with the "Ceratitis Hispanica" which is found on the coast of the Mediterranean. But notwithstanding its being looked upon by some as a variety of the same it is still an entirely different species.

With a view of studying the biology of this Diptera, the late Sir Henry Torrens named a Committee, in 1889 under the presidency of the

late Major General Hales Wilkie, who having made inquiries and studied the metamorphosis of the insects, and placed himself in communication with distinguished foreign professors, deemed it his duty to make known to the public what he and the Committee learnt relative to the insect in question from both a technical and practical point of view.

Biology:—The fly presents a sexual dimorphism which consists in the male having two clubshaped projections on the forehead.

It is very lively and hardy, so much so, that when kept without food under a glass shade it maintained its energy for twelve days. The female flies perforate the rind of fruits and deposit their eggs therein, from which in a few days appear the larvae, these destroying the pulp of the fruit causes it to fall to the ground where it soon decays.

The spot perforated is indicated by a dark stain, in the centre of which may be observed a small hole, this admits the air necessary for the respiration of the larvae and through it the latter pass out when they cannot find other ways. These openings in the fruit cause it to rot.

The female insect prefers to lay its eggs on the side of the fruit most exposed to the sun because these insects display their fullest energy under the influence of the direct rays of the sun.

The larvae form their cocoons under ground but one of the members of the Committee, Mr. Alfonso Micallef, has observed in his garden cocoons in the chinks of walls. This shows that the larvae go there to undergo the metamorphosis in chrysalis.

We have not been able so far to ascertain how many generations are produced during the year but it is certainly more than one.

The wings of this insect are semi-transparent with about sixteen brown and yellowish spots. Its claws are yellow, the head is of various colours, the breast speckled and the belly dark yellow. We have thought proper to give this brief description in order to refer the reader to that of the renowned Professor Penzig of Genoa at page 472 of his work entitled—"Studi Bottanici sugli agrumi e sulle piante affini."—Roma Tipografia Eredi Botta 1887.

Means proposed by the Professors consulted and by the Committee.

In order to rid gardens of this destructive insect which not only consumes acid fruits but also peaches, medlars etc:—at present scarce in the market on account of this insect, it was proposed by some to gather the infected fruit and destroy it by burning. But Major General Hales Wilkie suggested a plan which he himself had tried in his own garden. This consists of collecting all fallen fruit before the maggots had time to come forth and bury themselves in the soil, and placing it in tanks of water, where a mash might be made that afterwards might be utilized as manure.

The placing the fruit thus pounded in a pit dug in the garden and covering it with quick lime is highly recommended. The caustic property of the quick lime kills the larvae.

The President had each fruit wrapped in a muslin bag which was also found to be most efficacious.

The celebrated Professor G. Canestrini of the University of Padova favoured us with a letter in which this zoologist expressed a hope that the Dipterans in question, following natural laws, after having appeared in such large swarms will begin gradually to decrease in number to such a degree as ultimately to inflict no appreciable damage to harvests. Notwithstanding this however, the writer recommends prompt action to be taken against such a pernicious insect.

We publish herewith a letter from Professor Penzig who refers to a work from which we quote the following remarks for public information.

Istituto Bottanico.
della R. Università di Genova.
23, April 1889.

I have much pleasure in acknowledging the receipt of your letter of the 19th inst, and in reply I beg to inform you that the insects that you sent me were HALTEROPHONA HISPANICA. Rondani *Ceratitis hispanica.* De Brème), a species that is very similar to H. CAPITATA. Rondani. (*Ceratitis citriperda.* Mc Leay). In the few pages that I have enclosed with my letter and which are taken from my work, "Studi botanici sugli agrumi e sulle piante afini" Roma 1887 you will find some detailed observations on life and habits of this insect Page 473-477 which will I think be of great interest to the Commission. I would specially

recommend the perusal of pages 475, 476 & 477 in which suggestions are given as to the best methods of destroying this pest. I do not doubt but that, if the measures that are proposed be vigorously adopted, the island will in a short time be rid of the pernicious presence of the *Haterophora*.

At present I have nothing to add to the suggestions that I have made in those pages, for experience has taught me that they are the best. Should you require any furthur information, I shall be at your service.

Yours truly

Prof. C. Penzig.

The injuries caused by "Haterophora Hispanica" are sufficiently serious to make it important to ascertain a means of thwarting the invasion of such an unwelcome guest and it ought not be difficult to place an obstacle in the way of its excessive diffusion. It would suffice to apply vigorously and on a large scale the following treatment.

It is obvious that the stage during which we can most easily seize this fatal insect is that of the larval.

The develcped insect with its wings and activity can easily evade our persecution.

The pupae hidden in the ground are still more difficult to find, but the larvae can easily be caught during the stage of their development in the fruit. In the regions infested by the "Halterophora" or "*Ceratitis Citriperda*" it would be necessary for all owners and cultivators to send every morning boys or women to gather in sacks all the fallen fruit whether it shows or not the spots characteristic of the fly, and that the fruit thus gathered should be destroyed in the most radical and economical way possible.

It has been proposed by some to burn it, but this operation besides being awkward on account of the quantity of water stored in the pulp of the fruit, also involves the total loss of the same. There are two means of destruction equally efficacious which allow of the utilization of the rotten fruit.

The first of these methods only applicable in regions where there is plenty of water would be to throw all fruit gathered into a special tank filled with water. The larvae would undoubtedly perish and the mash formed, after the lapse of some time, from the fruit in the water would make very good manure. It would however be necessary to watch carefully that the water level be constantly maintained somewhat above the fruits, because should any of the latter be above the water the place destined for the destruction of the larvae would be turned into a great depository for the insect.

The other method is perhaps more rational and easier to carry out.

The damaged fruit should be collected in deep square pits excavated in the soil, the bottom and sides of which should be coated with caustic lime and as the fruit is gradually deposited in them covered with a layer of quick lime; when the pit is filled up it must be finally covered with a last layer of lime and earth. The buried fruit in due course decays, and the contents of the pits form a rich accumulation of fertilizing substances of no little value to agriculture.

Two things should however be observed if the desired effect is to be realized.

First, the collection of the fruit should not be limited to the acid species, such as oranges and lemons, but should be extended to peaches, pears, apples, nectarines etc attacked by the "*Ceratitis Citriperda*".

Secondly, it would be necessary for all cultivators to adopt the same treatment, since should a single orchard or fruit grove infested by this insect, be unattended to, it would immediately become the centre of constant infection to all the neighbouring gardens, and all the labour bestowed on the others would be thus thrown away.

Many methods prescribed by various authors were tried as well as others suggested by some of the members of the Committee, especially by the late President who spared no pains to find an economical remedy of destroying this pest. Of the methods suggested, some proved useful in banishing these insects from the trees, but they were not easy to carry out, and people did not care to apply them because they involved some expense.

C. Tagliaferro.

Secretary to the Commission.

Fish remains in the Upper Limestone of Malta.

Fish remains in the Upper Coralline Limestone of the Maltese Islands are considered by many geological observers to be non-existent. There is no doubt but that they are very rare, and therefore when specimens are found the discovery is worth recording. While engaged on this formation in the vicinity of Miggiar Elma last week I was fortunate enough to find embedded in division b. a fragment of a fish bone, genus and species indeterminable, which measured $5\frac{1}{4}$ inches long, $2\frac{3}{4}$ inch in width and from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in thickness.

J. H. C.

Maltese Mosses.

To Prof. Sickenberger's list of Maltese mosses we may add a short reference to our Moss Flora which appeared in *Malpighia* Vol. IV., fasc. V-VI, 1890—under the name of—"*Note di Briologia Italiana per Ugo Brizi.*"

Of the six species here mentioned as received by Prof. Pirotta from Mr. Alfred Caruana Gatto the following must be added to Prof. Sickenberger's list:—

Eurhynchium circinatum Schimh Bryum argenteum L. var. hirtellum De Not of Tortula muralis Hedw. Var. aestiva Paul de Beauu. Pleurochaete squarrosa Brid.

Estivation.

A rarer and even more curious phenomenon than hibernation, or winter sleep, is the estivation, or torpidity during the dry season, of certain animals. As one of the mammals which is most sensitive to heat and dryness, M. L. Cuonot mentions the tanrec, of Madagascar, an insect-eating creature resembling the hedgehog. It is very active during the rainy season, but lies torpid in a shallow burrow for nearly six months in the dry period. The most remarkable summer sleepers, however, are found in the group of dipnoids, intermediate between the batrachians and fishes, and comprising at present but three animals—the *Lepidosiren paradoxa* of the affluents of the Amazon, the *Protopterus annectens* of Gambia and Senegal, and the *Ceratodus Forsteri* of Australia. Their anatomical structure resembles that of the fishes, and a bronchial apparatus allows them to breathe in the water, while a pulmonary apparatus enables them to absorb the oxygen of of the air. A careful study of the Protopterus shows that during the entire dry season, lasting about nine months, it remains buried in the dried-up mud at a depth of five feet, and is surrounded by a sort of cocoon, which encloses it hermetically. Air penetrates through a narrow channel to the animal, which in this state breathes not only through a lung-into which the swimming-bladder is transformed-but through its wide membranous tail. On the return of the rainy season, the dried mucus covering the animal dissolves, and the creature straightens out from its doubled-up position, and swims in the water for three months.

Notes on Stereodon Melitensis, Owen.

By John H. Cooke, F.G.S., etc.

In the year 1865 portions of the upper and lower jaws of a large extinct fish that had been found imbedded in the Globigerina Limestone(1) of Malta were submitted by Dr. Leith Adams to Professor Owen for identification. Adams had considered them as being the remains of a crocodilian; but in a paper that appeared in the Geological Magazine for April, 1865, (2) Owen pronounced them to be the remains of a large extinct fish that belonged to "the cycloid order, and having sauroid dentition," and he proposed that "this fine addition to Miocene Tertiary fishes" should be known by the name of *Stereodon Melitensis.*

A portion of the bony skeleton of a fish of the same species was also discovered in the same locality; but as it was not sent with the other specimens, it has been neither figured nor described.

In the course of his paper Owen repeatedly refers to it, and finally concludes by saying, "It is much to be desired that the rest of the skeleton of this extinct fish should be figured." No attempt

(1) *Bed IV. The "Freestone" of Spratt and Adams.*

(2) *"Stereodon Melitensis," Owen, Geol. Mag. April, 1865.*

has, hitherto, been made to carry out this suggestion, and as no record of this interesting specimen exists, I have therefore visited the Malta Museum wherein the fossil is now deposited, and have obtained the following particulars relating to it.

The specimen is oblong in shape, and measures 22⅜ inches from the snout to the 10th dorsal vertebra. It consists of a fragment of the head, and a portion of the vertebral column, the latter of which extends as far as the 10th dorsal.

The vertebræ are circular in shape, and they form a continuous chain which curves slightly in a downward direction. They are well ossified, but, unfortunately, most of them have been badly developed from the matrix, and their characteristic features have thereby been obliterated. The 1st, 2nd, 3rd, and 5th are, however, in an excellent state of preservation; and the 10th vertebra distinctly shows deep lateral pits longitudinally extended. Each vertebra is bi-concave, and its body is somewhat depressed towards the middle. Compared with the posterior diameter, the antero-posterior diameter is much the shorter of the two.

Posterior diameter of the 6th dorsal vertebra... 1½ inches.

Antero-posterior of the 6th dorsal vertebra... ¾ of an inch.

Posterior diameter of the 10th dorsal vertebra... ⅝ of an inch.

Antero-posterior of the 10th dorsal vertebra... ¾ of an inch.

The average diameter of the posterior extremities is 1⅜ inches.

Above and below each of the vertebræ exhibits a broad protuberance, which forms the base of a long, sword-shaped spine, the flattened sides of which lie in a plane with the vertebral column, while the thin edges lie in the direction of the articular facets. These spines are anchylosed with the neural and hæmal arches of the vertebræ. They average three inches in length, and half an inch in width. The neural spines spring obliquely upwards and backwards from the centrum, while those on the hæmal side spring obliquely downwards and backwards, and gradually become shorter and more slender as the caudal extremity is approached.

There are no traces of scales.

Considerable portions of the bones of the head have been preserved in the limestone matrix, but most of them are so crushed as to be quite unrecognizable.

A fragment of the left branch of the lower jaw, containing a tooth which is similar in every respect to those that formed the subject of Prof. Owen's paper, is intact, and thus affords an opportunity for the comparison of the two fossils.

Geological Magazine.

Some Strange Plants.

The line between the vegetable and animal kingdoms is very narrowly drawn. Indeed, as all naturalists are aware, there are certain forms of lowly life which it is difficult to assign to either kingdom, presenting as they do features which, taken singly, might cause the one to be identified now with one and now with the other. But even in more highly developed forms there are instances of plants whose carnivorous habits seem to suggest some survival of a former animal instinct, or at least some strange adaptation to circumstances of a nature entirely opposed to those by which the great bulk of plant life is affected.

The Liverpool Post contains a description of an adventure that befel a naturalist who has recently returned from Central America. This gentleman after two years study of the botany of that region, has brought with him a story which, if it be anything more than a "traveller's tale," may well make us thankful that the woods of our temperate clime contain nothing more inimical to the integrity of the human form than burrs and briars. He tells of a strange plant which he found in one of the swamps surrounding the Nicaragua lake. While hunting for specimens he heard his dog cry out, as if in agony, from a distance. Running to the spot whence the animal's cries came, Mr. Dunstan found him enveloped in a perfect network of what seemed to be a fine, rope-like tissue of roots and fibres. The plant or vine seemed composed entirely of bare, interlacing stems, resembling more than anything else the branches of a weeping willow denuded of its foliage, but of a dark, nearly black hue, and covered with a thick, viscid gum that exuded from the pores. Drawing his knife Mr. Dunstan attempted to cut

the poor beast free; but it was whith the very greatest difficulty that he managed to sever the fleshy muscular fibres of the plant. When the dog was extricated from the coils of the plant Mr. Dunstan saw to his horror that its body was bloodstained, while the skin appeared to be actually sucked or puckered in spots, and the animal staggered as if from exhaustion. In cutting the vine the twigs curled like living, sinuous fingers [illegible] and it required no slight force to free the member from their clinging grasp, which left the flesh red and blistered. The tree it seems is well-known to the natives, who relate many stories of its death-dealing powers. Its appetite is voracious and insatiable, and in five minutes it will suck the nourishment from a large lump of meat, rejecting the carcase as a spider does that of a used-up fly. Another strange plant that has lately been discoved flourishes in masses resembling huge gray bowlders from five to ten feet. across, covered with lichens and grass, are seen in the lowlands of the Falkland Islands, and each one, proves to be a single umbelliferous plant, a specimen of balsam-bog (*Bolax glebaria*). These have grown so slowly, and have been so compressed in branching, that they are almost as hard as the rocks they resemble. The circlets of the leaves and leaf buds are seen as a tiny hexagonal, markings, terminating a multitude of stems, which have been steadily growing for centuries. The plant emits a pleasant odor in the warm sunshine, and the top exudes an astringent gum that is prized by the shepherds.

The New Star.

Nothing in the heavens has a greater interest for astronomers than the so-called "new stars," that occasionally appear, because nothing bears greater possibilities of new revelations concerning the mysteries of the universe and of those unknown depths of space toward which the human mind ever turns in helpless wonder. The new star now shining in Auriga was first detected on Jan. 31—not by a professional astronomer, but by a clergyman of Edinburgh. It has been photographed, however, at the Harvard Observatory two months before its discovery. It seems to have reached its maximum, as a star of the fifth magnitude, in February, indicating that it will not long remain in view. During the observations already made, spectroscopists have found evidence of a double spectrum, and that one component body of the star must be receding from the earth at the tremendous rate of 300 miles per second, while the other is approaching. In a period of 20 days, Mr. J. Norman Lockyer could obtain no proof of a revolution of one body about the other. He concluded, however, that the changes observed are exactly what would be expected according to his hypothesis that new stars are produced by collisions of meteor-swarms, the rapid fading of the star demonstrating that small bodies and not large ones are engaged. Other astronomers look upon the star as a variable of long period, which at minimum sinks to invisibility.

Wind-action in Egypt.

By W. M. Flinders Petrie (1).

Egypt is an especially favourable country for studying certain causes of geographical and geological change. The absence of all effective vegetation above the Nile level, enables any one to see the surface conditions at a glance. The absence of rain, except in occasional storms, leaves the wind action in remarkable prominence, and allows us also to see the effects of a different climate, now long past. And the presence of dated monuments throughout the country, extending farther back in history than any other series of man's works, gives more precision to estimates of time than can be obtained elsewhere. Though my own work has been among the historical remains, yet many geological evidences have come before me, to which I wish to draw attention in hope that some thorough examination of so valuable a district may be made.

The Isthmus of Suez is an important tract both for the connection of that sea with the Mediterranean, and also for the various events connected with that region. But the evidences of change there are more complicated than we might suppose; upheaval, depression, and denudation all coming into play. That the Delta as a whole is sinking at

(1) *Read to the Geographical Section of the British Association, Newcastle.*

about the rate at which the Nile deposits are being piled upon it, seems certain. At Naukratis, on the west side of the Delta, the rise of land by deposits has been 4⅓ inches per century; and at Tanis on the east side, and nearer to the coast, the water level as shown by a well there has risen 4¼ inches per century, though the country is now barely above the sea. At Ismaliyeh in the middle of the Isthmus of Suez, the land has, on the contrary, risen. The present lake there is necessarily on the sea-level, as the canal opens into it; and 10 or 15 feet above the water may be seen a line of thin fragile shells which seem probably to have been formed near the water surface, and which cannot have been exposed for long ages, to judge by their condition. The same late date of this elevation is also shown by the pottery of a Roman village stopping short at the level of the shells, and not extending down to the present water. The position of this site is W. N. W. of Tusun, at the spot marked *Ru.* in the War Office map. The elevation of this region accords with the historical evidence of the head of the Red Sea having extended up to Ismalieh; as, when it was 15 feet lower, the submerged region would have been much larger than at present.

These changes of level are, however but a part of the modifiying forces. The wind-action, which is so strikingly seen in this region, is probably quite as powerful a cause of changes as the elevation of the land. The most visible signs of such a force are seen on the western side of Lake Ismailiyeh. Here a high sand-dune forms the limit of the lake, sloping down into it at the angle of rest, and often obliging the traveller to walk in order to pass the foot of the slope. At such points as this it is evident that the lake must be rapidly filled up and modified. But the historical evidence shows that the whole hills have been swept away from the surrounding country in the last two thousand years. The Greek camp of Daphnæ, about 12 miles from Kantara on the Suez Canal, and bordering on the marshes of Lake Menzaleh of the Mediterranean coast, was surrounded by a wall of crude brick about 40 feet thick, and over a mile in circuit. In proportion to the thickness, and to other such Egyptian town-walls, the height was certainly 30 feet, and probably more. Yet the whole of this mass of hard mud brick has been so utterly swept away by the wind that only the buried foundation remains. Rain has had no share in the actual removal of the clay, as there is no wash from the wall upon the ground on either side. The whole mass, at least 40 feet by 30 in section, has been carried away and deposited elsewhere by the wind alone.

The above is not an isolated case. Some 15 miles to the west is the ancient cemetery of Tell Nebesheh. The tombs have been buit of mud brick in a large rise of sandy ground, such as is often seen in the mud flats of the Delta. These tombs were subterranean chambers about six feet high, with well-shafts leading to them. But only two or three now exist entire, sufficient to explain the remains of the others. In most cases the chamber has been nearly removed by the wind-denudation of the whole hill. This shows that about eight feet, or more, of soil has been carried away in 2600 years, or nearly four inches per century. The wall of crude brick around the temple at Tell Nebesheh, though 30 to 40 feet thick, has been swept away by the wind like the wall of Daphnæ, down to the ground-level.

The question naturally arises, where has all the material thus removed been deposited? In a continuous desert the sand-dunes may march on slowly for years, and the furious sand-storms drop their burdens only to be picked up again in the next gale. But in a district intersected by marshes and lakes there is a perpetual trap for all loose material, and whatever touches the wet surface never rises again. Hence all the water will be continually rendered shallower by constant filling up in high winds, and great extents of sandy marsh and very shallow lakes will be formed. This is precisely what we find the most prominent feature of all this region.

Subtracting then the effects of the causes which we have seen to be at work, the deposit of the Nile, the changes of level of land, and the denudation by the wind, we may form some idea of what the appearance of the district must have been some few thousand years ago, when the earliest monuments of human occupation were erected. At that time the eastern side of the Delta must have been more like a part of the neighbouring desert, with hills about 30 or 40 feet high; the Nile flowing down between them, and spreading out

into the side valleys, depositing the Nile mud as a level bottom across the valleys. Gradually the deposits rose, the wind ploughed down the hills, and laid the material in the water around, until at present we only see the tops of the denuded hills just appearing as patches and ridges of sand amid an expanse of mud. Meanwhile the coast sank, and the large region of Menzaleh was in Arab times inundated by the sea, and lost to cultivation. The Isthmus at the same time was rising; until, by the general elevation, and the masses of sand blown into the water, the head of the Red Sea was broken up and formed only a chain of half-choked saline lakes, through which the Suez Canal now runs. But whether we turn to the north coast or to the isthmus, we see that the wind-action is probably a cause of change of equal power with the deposits of the Nile or the variations of level of the land.

So far we have only reviewed the changes of the historical period; but up the Nile valley are some of the most brilliant evidences of the enormous climatic differences which rendered the country in the prehistoric human period wholly different from what it now is. That the land was lower, and that the Nile ran into a long estuary, in prehistoric times is usually granted. But there is also no question that a great rainfall over all the country swelled the volume of the river, so that it far exceeded the present stream of even the inundation. The problems yet to be solved are, what was the limit of salt water, and the limits of river and estuary? What was the volume of the Nile? and what was the date in chronology and in civilisation when the present state of the country was established? As illustrations in point I would instance the following examples. The enormous rainfall of the Nile valley is shown by the cliffs at Thebes. There a narrow ridge of limestone, a sort of wall, separates the vertical cliffs at Deir el Bahri from the equal precipices at the head of the Valley of the Tombs of the Kings. This ridge cannot possibly have received surface flow from either end—nor, being limited by cliffs on either side—can more than the catchment of a few hundred feet in width have ever poured over the edges of this dividing wall. Yet the hard limestone is grooved out into a row of wide pipe-shaped grooves down either face, the breath and close order of which show the volume of rain which must have poured down them. The same story is shown equally plainly in the water-courses which cut up the Nile cliffs into a fringe of ridges divided by deep ravines. These ravines are often a couple of miles in length, and a quarter of a mile in width, cut down through two or three hundred feet depth of rock by a waterfall, of which the evidence remains in the precipitous head of the ravine, the polished rock surfaces over which the cascade has poured, and the deep cauldron scooped out by the descending stream. Yet the catchment basins of such eroding forces are sometimes not over a few square miles in area.

That such erosion took place during the period of the high level of water in the valley, be it fluvial or estuarine, is shown by the height reached by the great banks of debris washed out of the ravines, and piled up as a foreshore to the cliffs next below those torrential valleys. This is very finely seen at Beni Hasan. And it seems most probable that the celebrated wash-beds at Thebes, in which General Pitt Rivers—and later myself--have found wrought flints, were also deposited beneath the water, by the torrent from the Valley of the Kings' Tombs. It seems improbable to suppose a subaerial stream spreading out its material in such a wide fan; rather we see, both here and at Beni Hasan, how a subaerial stream will, on the contrary, cut through such broad beds of subaqueous deposit by deep subsequent ploughings. That the age of the high water was within the human period, and that therefore the Theban beds might be subaqueous, is proved by the river-worn palæolith of characteristic appearance, which I picked up hundreds of feet above the present Nile on the desert cliffs of Esneh.

I have now briefly shown what an interesting ground for research still awaits the geographer and geologist in Egypt; and how the conditions of the country render certain problems far more simple than they are in lands with continuous rainfall. Let us hope that our present facilities in Egypt may bring about some complete study of the subjects on which we have now touched.

Exploration in the Black Sea.

On December 16th Captain Spindler read before the Russian Geographical Society a paper on his deep-sea explorations in the Black Sea during last summer. They were made, in May, on board the war-sloop *Donets*, and in July, on board another war-sloop the *Zaporojets*, to complete the explorations of the previous year, and to verify more closely the interesting results of that year's researches. In May, the soundings were carried on in the north-western parts of the Black Sea, and along lines crossing the sea from Sebastopol to Sinope, to Constantinople, and to Varna. In July, they were made partly along the same line, and partly in the south-east and along the coasts of Anatolia and Caucasia. No less than 128 soundings, of which 58 were at great depths, were made during these two cruises, and at each spot the temperature, the density, and the salinity of the water were measured. Samples of water taken from depths above 100 fathoms were chemically analysed. The time between these two cruises was given to the exploration of the Sea of Azov on board the schooner *Kazbek*. The Soundings made in 1890. The 100 fathoms' line lies close to the shores of both the Crimea and Anatolia, and the axis of the greatest depression has a direction from south-west to north-east. The steepest coast was found at Rizo, situated between Batoum and Trebizond, where the angle of inclination attains 10°. The water of the Black Sea begins to be warmed by the air in May, and in August its temperature is higher than that of the atmosphere. The variations of temperature at the surface lie betwen 77° and 43° to 41° Fahr., while on the northern shore it is sometimes cooled down to 32° Fahr. Below a depth of 200 fathoms the temperature is invariably 48°, this high temperature being due entirely to the deep current of warmer and salter water which flows from the Mediterranean through the Bosphorus, as fully appears from this year's soundings. The annual variations of temperature due to the seasons do not penetrate deeper than 100 fathoms; this depth may also be taken as the average inferior limit of organic life, the deeper strata of water being infected with sulphureted hydrogen. As to the Sea of Azov, which has no depth more than eight fathoms, its water is so thoroughly mixed by each gale, that no difference could be detected between the temperatures and densities at the surface and at the bottom. The observations upon currents fully confirmed the existence of a circular current which flows from the Crimea to the north-west, and then south in the western part of the sea. As to the flora and fauna of the Black Sea, Captain Spindler is of opinion that his observations fully confirm the opinion current among many Russian explorers, namely, that formerly it was a closed basin, which had a fresh-water fauna; but that since the Bosphorus was pierced, and gave access to salt water, this latter took possession of the greater depths, and compelled the former fresh-water fauna to migrate to the mouths of the rivers. But further biological exploration is required—this one fact being, however, quite certain, viz., that below the 100 fathoms' layer there is no organic life, because the water is so much impregnated with sulphureted hydrogen.

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NOTES AND NEWS.

A meeting of the members of the Botanical Society of France was held at Biskra in Algeria a fortnight ago.

Much as the Mediterranean mosquito has to answer for, the effects of its attacks are mild compared with those of the mosquito of Newfoundland and Northern Asia.

The sting of the pests in these districts is sufficiently powerful to perforate a leather glove.

A writer in *Nature* giving a resumè of the reasons adduced by Dr. A. Woeskof of St. Petersburgh to account for the famine in Russia, attributes it principally to drought from August to October 1890 which injured the winter crops; to partial and insufficient snow which melted early in the Spring and was followed by frost in April; and

lastly to drought and hot winds from May to July 1891.

In the southern portion of the Government of Samara the prospect up to June 10th was excellent, but the harvest was destroyed by two days of hot winds on June 14 and 15. And in the southern central provinces also where the winter crops had greatly suffered, a moderate harvest was hoped for after the middle of July, but four hot days from July 13 to 16 quite destroyed the crops.

There are, says Prof. W. H. Flower, at least seven modifications of the horse type, at present or very recently existing, sufficiently distinct to be recognized as species by all zoologists. They are, however, all so closely allied that each will, at least in captivity, cross with perfect freedom with any of the others. The two species which are, perhaps the furthest removed in general structure,—the horse and the ass—produce, as is well known, mules, which excel both their progenitors in some qualities useful to man.

An interesting addition to the Museum of the Malta University has recently been received from Mr. John H. Cooke. It consists of a suite of the Maltese Fossil Echinoidea, similar to those that have lately been presented by the same gentleman to the British Museum and to the University of Bologna.

A correspondent to *Nature* gives the following interesting facts relating to the strength possessed by certain animals. The shell-less limpet pulls 1984 times its own weight when in the air, and about double when immersed in water. Fasting fleas on an average pull 1493 times their own dead weight, while the Mediterranean cockle *Venus verrucosa* can exert a pulling power equal to 2071 times the weight of its own body.

So great is the power possessed by the oyster that to open it a force equal to 1319.5 times the weight of its shell less body is required.

The colours of the waters of the Mediterranean vary considerably at different seasons of the year and in different localities. During storms and boisterous weather it assumes a deep green and sometimes a brownish tint, but when calm and undisturbed it is of a bright, deep blue. In the Bosphorus, and among the islands of the archipelago it is of varying tints in some places being of a liquid blue graduating into a brighter green, and in others assuming a blue so deep in its intensity as to almost approach a purple.

For more than 2000 years, a dressed stone containing 12,922 cubic feet—being 71 by 13 feet in size—has rested on pillars in a quarry at Baalbac, in Syria. It was intended for the foundations of the temple of the Sun, a mile or more distant, to which four stones nearly as large were actually transported.

Coal is mined in Turkey, in Heraclea and Koslu, both on the Black Sea, and about 100 miles from Constantinople. The mines at Heraclea are controlled by the Ottoman Government; the Koslu mines by a private firm, Kurtschi & Co. The coal obtained is inferior in quality to the English mineral, especially to the Cardiff and Newcastle coal.

A writer in *Nature* informs us that in connection with the celebration of the fourth centenary of the discovery of America by Columbus, the Italian Botanical Society invites the attendance of botanists of all countries at a Botanical International Congress, to be held at Genoa, from the 4th to the 11th of September.

In addition to the meeting for sceientific purposes, there will be excursions on the shores of the Mediterranean and in the Maritime Alps; and during the same time will also take place the inauguration of the New Botanical Institute built and presented to the University of Genoa by the munificence of Mr Thos Hanbury, of La Mortola, and the opening of an exhibition of Horticulture.

All communications should be addressed to Prof. Penzig, of the University of Genoa.

The *British Naturalist* for April contains a capital portrait and a short biographical sketch of Miss Eleanor A. Omerod the celebrated entomologist.

As an authoress Miss Omerod's name is a household word in the agricultural countries of Europe, America, and Africa; but in the Mediterranean districts she is especially well known for her researches into, and practical remedies for the extirpation of the insect pests that infest them. In 1889-1890 her services were called into requisition by the late Major General Hales Wilkie the President of the Malta Orange Disease Commission.

Professor Loeffler of the University of Greifswald has just arrived in Greece, to which country he has been invited by the Hellenic Government, to give his assistance in a scheme for stamping out the present plague of mice in Greece by the use of the mouse typhus bacillus, which he discovered.

From Helsingfors comes an account of an extraordinary archaeological find, consisting of a chest containing a quantity of ironwork, and a parchment giving a Latin treatise on steam as a force. The pieces of iron form a rudimentary steam engine, which must date from the first half of the twelfth century.

"Silver thaw," or rain falling when the air is below freezing point and congealing as it falls, has been the subject of considerable study at Scotland's mountain observatory on Ben Nevis. The phenomenon indicates an inversion of air temperature at the time, the hill-top being considerably cooler than higher atmospheric levels. During the six years ending with 1890, no less than 198 cases of silver thaw were observed, having a mean duration of 4½ hours. The phenomenon is practically confined to the winter months, being rare from April to October and unknown in July. It occurs usualling during a light wind, fluctuating barometric pressure, rising temperature, and seldom when the thermometer stands below 27°. It is very often followed by severe gales.

The British Museum authorities have just issued the second volume of a remarkable catalogue, says the London *Standard*. Stored in the drawers and cases of the Museum are some 50,000 inscribed pieces of terra cotta or clay tablets, forming the rescued portions of the great libraries of Assyria and Babylon. The great impetus given to cuneiforn studies during the last few years in Germany and America, where they form part of the curriculum for a degree in Semitic languages, has made it necessary that the treasures of the British Museum, the centre of Assyrian studies, should be catalogued, and the trustees have now issued these volumes, containing a descriptive catalogue of some 8,000 inscribed tablets The insciptions in question come from the Kuyuryik Mound, on the site of ancient Nineveh, which marked the ruins of the great palace and library founded by Assurbanipal, or Sardanapalus, in B. C. 650. The tablets embrace every class of literature, historical documents, hymns, prayers and educational works, such as syllabaries or spelling books and dictionaries. One of the most interesting sections it that of the omen tablets, produced by the court augurs and diviners. They saw omens in all things—the flight of birds, swallows, pigeons, the coiling of snakes, the movements of scorpions, the winds, the clouds, and, above all, the stars. The catalogues have been prepared by Dr. Carl Bezold, are beautifully arranged, and will tend to make the collections more accessible to students, and, in time, better known to the general public, who depend on specialists for the unravelling of the learning and wisdom of Chaldea.

Of the many brilliant discoveries that the eminent Swiss chemist Mr. Ludwig has made of late the most remarkable is the process that he has invented for the economical supply of steam motive power by means of coal. He tells us that by burning 125 tons of coal at a cost of £31 and making full use of it for steam raising purposes he can at the same time secure by a simple process that he has invented four tons of sulphate of ammonia from the smoke produced by the combustion of the coal. The market value of this product is estimated at £48.

In the course of an address to the Royal Meteorological Society given by Dr. C. Theodore Williams on the value of meteorological instruments in the selection of health resorts some interesting references were made to the principal of the Mediterranean watering places.

In the majority of cases, we an told, the reputation of health resorts depends entirely upon their position and the degree to which they are sheltered from the mistral, or north-west wind. Alluding particularly to the Riviera he showed three principal causes of the warm winters for which the district is noted (1). Its southern latitude, (2) the the protection from cold winds afforded by the mountain ranges, and (3) the equalizing and warming influences of the Mediterranean Sea which, being practically tideless, is always equally potent not varying with hour and season. The weak points of the French climate with its biting Mistral, its cold Bise, and enervating Scirocco were each in turn touched upon; but he concluded by pronouncing the Riviera winter climate as being, on the whole, clear, bright, and dry and with a temperature from 8° to 10° higher than England, with half the number of rainy days and four to five times the number of bright ones.

Notes on Books, etc.

The New Science of Healing by Louis Kuhne. Translated from the third German edition by Dr. Thos. Baker. (Williams and Norgate. London and Edinburgh. L. Kuhn Leipzig).

This work has for its object the exposition of the principles of what the author calls the "Oneness of all diseases," and the methods that he himself has practised in the course of a lengthened experience as a physician. Originally the book was published in German only but it has since been translated both into French and English. It is divided into three parts the first of which contains a series of lectures on the nature, origin, and cure of infant diseases, on rheumatism, gout, fevers, mental and nervous diseases, and female diseases.

It concludes with instructions for their treatment by means of a strict dietary and the use of friction, steam and other baths.

In part II. the author enters into detail respecting the treatment and cure of wounds. Lung-disease, cancer, heart-disease, leprosy, fevers, disorders of the bladder and kidneys, and liver complains, each in turn receive their meed of attention. Part III. contains a number of reports of the cures already effected. Containing, as this work does, so many simple and easily applied remedies for the multifarious "ills that flesh is heir to," there is no doubt but that, when known, it will be welcomed as a useful adjunct to every home library.

Journal of the British Archeological Society of Rome 1891. (Roma).

This is a very interesting report of the proceedings of the Society during the session 1891.

In addition to the transactions there are also several papers on various subjects among which is an account of a "Visit to the Temple of Diana at Ephesus," by F. S. Shenstone, J. P.

Report on the Volcanic Phenomena of Vesuvius and its neighbourhood. (Spottiswoode and Co., London).

This is the report made by Dr. Johnston Lavis to the British Association at the Cardiff meeting in 1891. In it he embodies the results of the investigations made by himself and his colleagues into the causes of volcanic energy among the rocks in the Neapolitan district and a detailed description of the phenomena that attended the eruption of June last, an account of which has already appeared in our columns.

During the month of July several changes took place after which the phenomena gradually became less frequent. The learned author considers that the size and position of the fissures around the great cone have rendered the cone somewhat unstable, but that they are in a direction most favourable for the next outburst. The report has five illustrations showing the various kinds of fumaroles that were formed after the eruptions.

Editor. J. H. Cooke. B.Sc., F.G.S., Malta.